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# **COST ESTIMATING GUIDE FOR ROAD CONSTRUCTION**



**REGION 4  
DIVISION OF ENGINEERING  
UNITED STATES DEPARTMENT OF AGRICULTURE  
FOREST SERVICE**

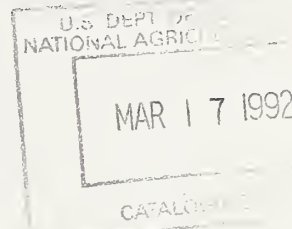
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## INTRODUCTION

This "Cost Estimating Guide" is intended to establish procedures and standardize methods of making estimates for road construction. The estimate should be made to reflect the costs of a public works contractor at the time actual construction would most feasibly take place. Costs in all sections include profit and risk, unless otherwise noted.

There is no formula that can be used to arrive at an exact construction cost. Each project is a unique situation. Experience, judgment, and knowledge of the job are prerequisites to arriving at an estimate that represents a fair market value for the work to be performed.

Costs included in this Guide are derived from responsible bids received in Region's Four and One in the past year, data from "Price Trends for Federal-Aid Highway Construction" and "Rental Rate Blue Book for Construction Equipment." Each Forest is responsible for developing their own base costs and making the appropriate adjustments.

Cost information should be completed in detail and submitted with the plans and specifications so that review and approval of the contract package can be easily accomplished. Narratives explaining basic assumptions should be included. The Forest Engineer has the responsibility of insuring that cost estimates have been carefully and accurately prepared, and must approve the estimate.

The Forest Engineer is also responsible for the cost estimate of temporary (purchasers) road and road maintenance shown in the timber sale appraisal. Close coordination between the Engineering Cost Estimator and the Sale Preparer is essential. Care should be taken to assure that estimated costs used in the appraisal are neither duplicated or omitted.

Implementation of the National Forest Management Act requires that the labor portion of each estimate be reduced for the difference in applicable wage rates to arrive at an estimate for allowable purchaser credit. The information concerning the difference in wage rates and the percentage of total construction costs involving labor can be found in the Appendix.

When this Guide is updated, the previous Guide or the updated pages should be placed in a separate file for future reference. Each Forest should maintain all previous "Cost Estimating Guide" material for a period of two years beyond the longest sale contract time on the Forest, for timber sale contract modifications.

ALL COSTS ARE CURRENT AS OF THE DATE SHOWN IN THE LOWER PORTION OF THE PAGE.





**SECTIONS 150-199 - ENGINEERING**



## SECTION 150 - PRELIMINARY ENGINEERING

### A. Road Location

Road location costs vary from \$300 to \$800 per mile depending on the length of road, access, terrain, and ground cover. A&E contracts in R-1 average \$650/mile with an additional \$600 for the location report.

### B. Survey

Survey costs for A&E negotiated survey and design contracts should be estimated using the bid prices from competitively bid projects as a base. In addition, estimates for these negotiated contracts should be adjusted upward to reflect the cost of extra work and additional overhead not included in competitively bid projects. Such additional work may include items such as material and clearing classification, special site investigation, and stream flow estimates. The additional overhead cost may be required because an organization engaged in survey and design work will often have overhead costs higher than a firm which only does survey work.

Low to medium accuracy standard survey costs vary from \$700 to \$1,000 per mile. R-1 A&E contracts show the following:

#### Preliminary Survey

Negotiated A&E Contracts		\$1,400/mile
Competitively Bid Contracts	\$ 800/mile	

#### Plotting Data

Profile, traverse, & cross sections	\$ 200/mile
-------------------------------------	-------------

### 1. Wages & Per Diem (from A&E negotiated contracts): 1/

	Fieldwork	Per Hour	Per Day
	Two-person field party	\$56.00	\$448
	Three-person field party	78.00	\$624
	Four person field party	100.00	\$800
	Supervisory person	35.00	\$280

Transportation

0.35/mile

\$200 plus/mo.

1/ Per diem per person-day (Lodging may be added to this cost) \$25

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2. **Production rate guides for estimating field work:**

a. **Brushing:** three person crew. The production for brushing is dependent on the density and size of stems and will vary with the contract requirements.

Density of stems	Miles per day
Extra heavy	0.35
Heavy	0.45
Medium	0.7
Light	1.0
Extra light	1.4

b. **Traverse:** three-person crew. The production for traverse is dependent upon the precision of survey and number of points of intersection (P.I.s) per mile. This cost estimate is broken down according to the precision desired. It is, therefore, mandatory for the estimator to know the precision required before making the estimate. The chaining difficulty is constant with the number of P.I.s per mile on which this cost guide will be based.

Survey Accuracy Standard - Miles per day

P.I.'s per mile	High	Medium	Low
60 to 70	~	0.5	0.6
50 to 60	~	0.6	0.7
40 to 50	0.3	0.7	0.8
30 to 40	0.5	0.8	0.9
20 to 30	0.6	0.9	1.0
10 to 20	0.9	1.0	1.1
5 to 10	1.0		

c. **Levels:** two-person crew. The production for levels is mainly dependent upon the precision of survey and ruggedness of the terrain. Therefore, this cost guide is based on average production figures for a given precision and moderate terrain. The estimator should use his/her own judgment and adjust these figures if they do not fit the individual project.

Accuracy Standard	Miles per day
High	0.5
Medium	0.7
Low	1.0

d. **Cross Sections:** three-person crew. Cross sections are generally constant in production between 0.4 mile to 0.7 mile per day. The brushing for extra heavy and heavy brush are figured in the brushing estimate. Therefore, this item will consider the sideslope only. If the estimator has unusual circumstances, such as may topography breaks, then the production figures should be adjusted accordingly.

Side Slope	Miles per day
50 percent +	0.4
30 to 50 percent	0.6
0 to 30 percent	0.7

e. **Supervision:** Allow 1 day per week of survey crew time for Supervisory Engineer.

f. **Checking Notes-office work:** All notes need to be office checked for completeness. Traverse and level notes need office work in recording and computation for angles and elevation. There is no per diem allowance for this work. Allow 3 hours per mile for one person at a rate of \$25 per hour.

### 3. Other survey costs:

- a. Allow for move-in/move-out costs, and supplies.
- b. Materials Investigation and Testing. See Section 160 for unit costs.

C. **Road Design (Average)** \$2,100/mile

D. **Site Survey and Foundation Investigation (per site cost)**

Negotiated Contracts \$1,100 - \$2,200

Competitive Bids \$ 250 - \$ 500

E. **Corner search, monumenting, boundary marking and posting.**

This work varies greatly by location and difficulty. It should be estimated on a site specific basis using local costs. Consult the Forest Land Surveyor or Region's Cadastral Surveyor when estimating the cost of this work.

## SECTION 160 - QUALITY CONTROL AND QUANTITY MEASUREMENT

Quality control and quantity measurement costs will vary with the length of job, distance from testing centers, and complexity of job. Estimators must base estimates on the anticipated time for testing, inspection, and travel, vehicle miles, and current testing facility charges for standard test.

### A. Quality control by contract item

SPS 160 requires contractor quality control and specifies sampling and testing frequency for specific items of work. The following percentages by item were derived from bids which included contractor quality control. Use the percentage to increase the item estimate when contractor quality control is required.

Items	203, 304, 590, 630	2-3%
	306, 552, 602, 603, 617, 619	6-10%
	410	18%
	206, 206A	20-31%



**B. Project field sampling and testing costs**  
(for time & equipment estimates)

**Personnel**

Vehicle	\$200/mo. + \$.30/mile
Per diem	\$40 - 60 plus lodging/day
Asst. Project Engineer	\$50/hour, assume 1 visit/mo.
Sr. Eng. Tech	\$36/hour, assume 1-2 visit/mo.
Eng. Tech	\$30/hour, required daily
Mobile Lab	\$200/week plus equipment surcharge
Equipment surcharges:	
Nuclear density	\$120/week
Gradation and Compaction	\$55/week
Concrete	\$50/week
Generator	\$60/week

**Tests**

	Average 1/	Range		
Sieve Analysis	\$ 33	\$25	-	\$ 70
Atterberg Limits	\$ 37	\$35	-	\$120
Proctor	\$ 85	\$70	-	\$110
In place density	\$ 30 2/	\$14	-	\$ 49
Concrete-				
Compression Test	\$ 8	\$ 6	-	\$ 13
Field Test (Slump, Air, Cast 3 cylinders)	\$ 44	\$48	-	\$105
Asphalt Design Full Mix (Marshall)	\$530	\$500	-	\$600
Extra Action Gradation	\$ 77	\$60	-	\$100

1/ When a mobile lab is used, add cost for a senior engineering technician.

2/ Hourly cost for a full time technician on the project.

*Note: Contact the RO Bridge section and/or Materials section for requirements on testing frequency, where applicable.*

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401 Ironwood Drive  
South Salt Lake, UT  
(801) 487-3661

Sergeant, Hauskins, & Beckwith  
4030 S. 500 W.  
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Murry, UT  
(801)266-0720

**SECTION 161 - QUALITY CONTROL AND QUANTITY MEASUREMENT**

Where no specific field tests are required and inspection by specifically qualified individuals is not necessary, an additional cost of \$60 - \$120 per week should be included for measurement and compliance reports. For estimating ease, this cost can be added to mobilization rather than spreading it over several items.



## SECTION 170-173 - CONSTRUCTION STAKING

These are average project costs. Assume that camp is within 30 minutes of project, access is at the beginning of the project, and project is not over 3 miles long.

### Average cost:

Specification 170: \$1,800/mi.

Specification 171: \$1,200/mi.

Specification 172: \$1,000/mi.

Specification 173: \$1,000/mi.

Average prices should be multiplied by the following factors to determine cost estimate.

### Approximate Relationships of Precision Options

Item	Precision					
	A	B	C	D	E	Other
170(02) Establishing Centerline	1.2	1.1	1.0	--	--	--
170(03) Slope Staking	1.2	1.2	1.15	--	--	--
170(04) Finish Staking Subgrade	1.1	1.05	1.0	--	--	--
170(06) Staking Major Structure(s)	1.0	1.0	1.0	--	--	--
171(02) Construction Staking Method I			1.1	1.0	0.85	
Method II			.65	.65	.65	
172(02) Construction Staking Method I				1.0	0.85	
Method II				.65	.65	
173(01) Establishing Clearing Limits						0.3
Finish Staking	1.1	1.05	1.0	--	--	--
173(02) Establishing Slope Stakes Method I				One side 1.0		
Method II				0.6		

Construction staking for bridges and major structures should be estimated by time and equipment calculations.

### Additional factors to consider:

Slope Staking		Side Slopes		Brush	
One Side	1.0	0 to 30%	0.9	Light	0.9
Both Sides	1.15-1.3	30 to 50%	1.0	Medium	1.0
		50% and over	1.1	Heavy	1.2

# CONSTRUCTION WAGE RATES

(Hourly Wage Rates\*)

JOB	Southern Idaho		Utah		Nevada		Wyoming
CLASSIFICATION	Zone I	Zone II	Area I	Area II	L.V.	Reno	All
General Laborer	22.84	25.05	20.05	23.83	25.44	23.27	10.75
Chain Saw Operator	23.28	25.49	22.84	24.14	28.83	26.46	10.87
Dozer Operator Under(1)	26.46	28.66	32.42	36.20	38.11	37.79	15.75
Dozer Operator (1) or Over	26.46	28.66	33.55	37.33	38.25	37.79	15.75
Grader Operator	26.46	28.66	34.69	38.47	39.64	38.87	15.75
Backhoe Operator	26.23	28.44	32.42	36.20	38.25	38.19	14.93
Wagon Drill Operator	23.28	25.47	26.90	24.46	26.07	23.90	14.36
Powderman	23.91	26.12	21.31	25.09	25.94	24.28	10.87
Hydraulic Excavator (Under 3-1/2 Yds.)	26.46	28.66	33.55	37.33	38.25	39.17	15.89
Front End Loader Operator (Up to 4 Yds.)	26.02	28.22	33.55	37.33	38.25	38.63	15.75
Front End Loader Operator (4-7 Yds.)	26.46	28.66	33.55	37.33	38.25	39.17	15.89
Truck Driver (2)	25.64	27.85	28.87	32.65	25.48	24.49	12.83
Truck Driver (3)	25.64	27.85	29.06	32.84	25.62	24.76	13.08
Asphalt Spreader Operator	26.46	28.66	33.55	37.33	38.25	37.04	15.75
Heavy Duty Mechanic or Welder	26.46	28.66	33.55	37.33	38.25	37.79	15.89

\*The rates shown include basic hourly rates, fringe benefits, a 20-percent allowance to cover Social Security, Workmans Compensation, and Unemployment charges, and a 5-percent profit margin assessed to the items mentioned above. Wage rates are subject to change at any time. The contracting specialists in Ogden or the zone specialists can provide the latest wage information as well as help you identify the are or zone of your job. See maps in Appendix for approximate location wage rate areas.

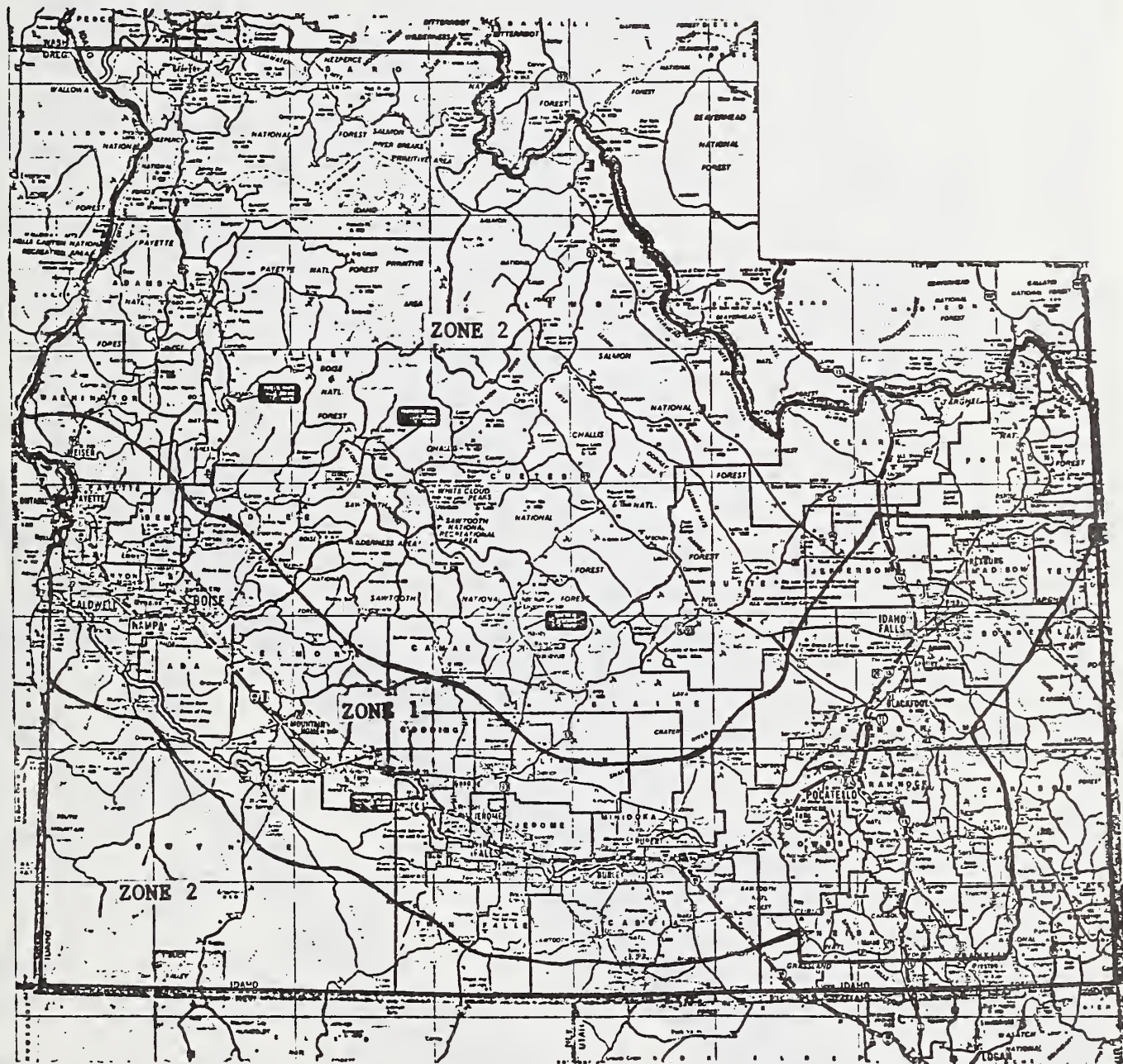
	Idaho	Utah	Nevada		Wyoming
			LV	Reno	
1. Dozer Size	Same	D-7	D-5	D-5	Same
2. Truck Capacity	0-16	0-8	0-12	4-7.9	0-7.0
3. Truck Capacity	0-16	8.2-14	12-16	8-18.9	7.1-13



I D A H O

DAVIS BACON AREA/ZONES

AREA 2

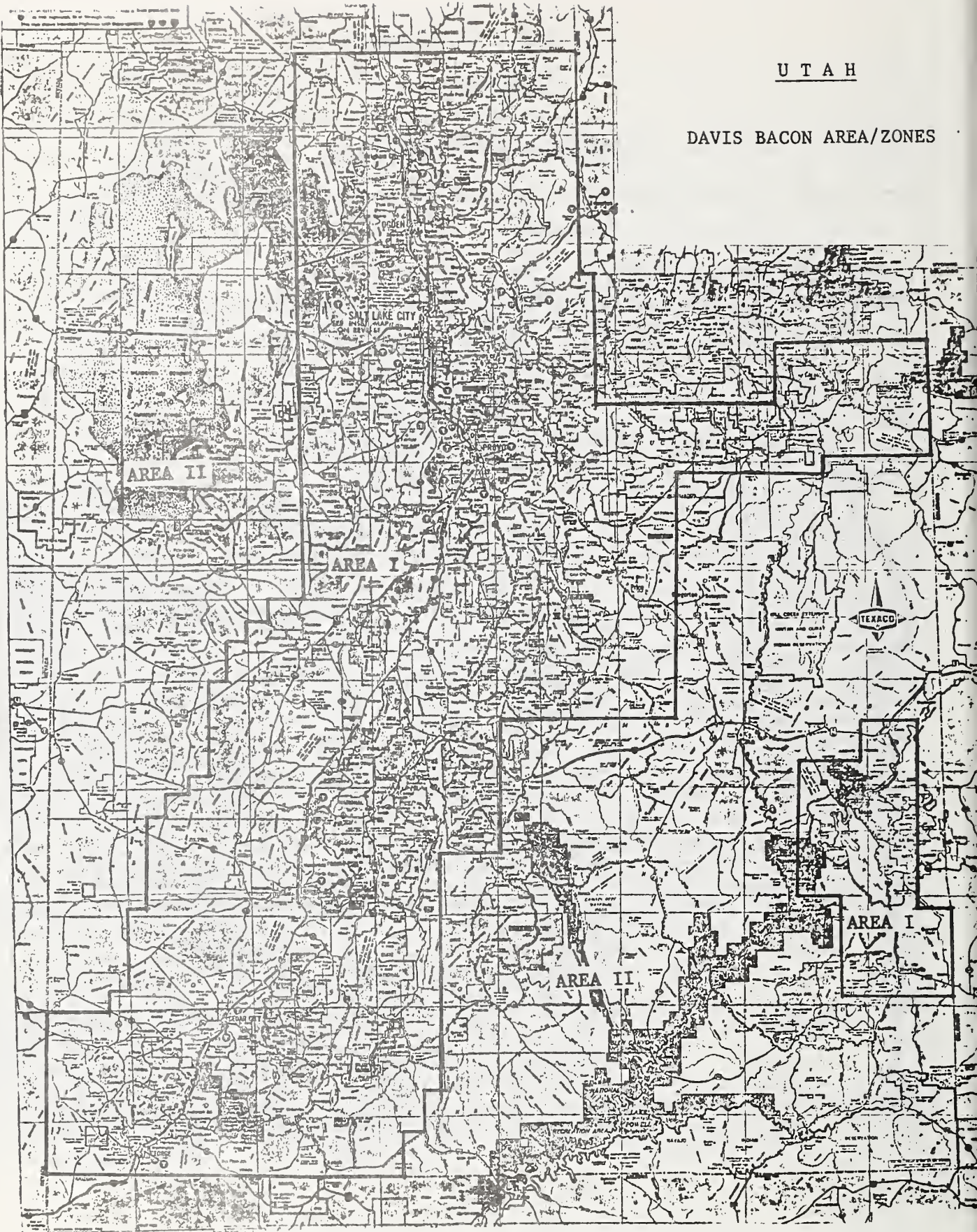


MAP 1



U T A H

DAVIS BACON AREA/ZONES

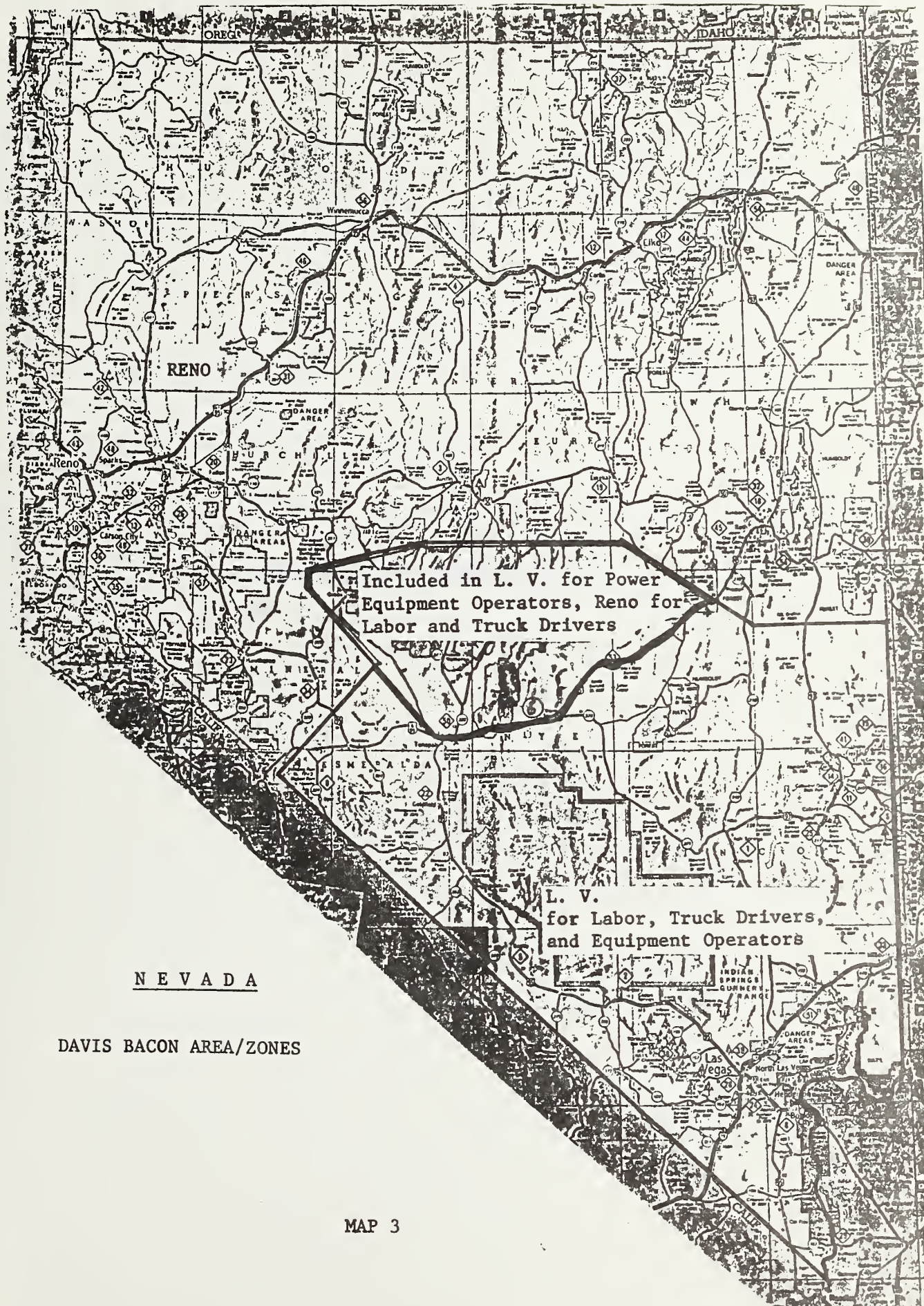


MAP 2

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NEVADA

DAVIS BACON AREA/ZONES

MAP 3





## **SECTION 200 - EARTHWORK**



SECTION 201 - CLEARING AND GRUBBING

A. **Clearing and Grubbing Costs** - See Table II for costs and Figure 0 for a clearing classification chart which defines clearing in terms of average diameter and stem spacing, or timber volume. "Grubbing" should be classified independently of "clearing" and may or may not be the same type. Volumes and stem spacing must include material on the ground as well as that which is standing. These costs include an allowance for logging the merchantable timber. In areas having "doghair" lodgepole, it should be considered light clearing when sawing of individual stems is not necessary. If sawing of individual stems is necessary, it should be considered as medium clearing.

B. **Slash Treatment Methods** - The following classification applies to the slash treatment methods in Table I. This classification assumes that the merchantable logs have already been removed.

- 1. **Extra Light** - Few tops and limbs. Few, if any, cull logs. Low scattered brush. Little or no falling of unmerchantable required.
- 2. **Light** - Light to moderate amount of tops and limbs. Few cull logs. Light brush. Little to moderate falling or skidding of unmerchantable timber required.
- 3. **Medium** - Light to moderate amount of cull logs. Many tops and limbs. Tall brush or dense unmerchantable trees requiring falling. Some unmerchantable material requiring skidding.
- 4. **Heavy** - Many tops and limbs from dense stand of merchantable timber. Tall, heavy brush of dense unmerchantable pole stand requiring falling and bucking numerous cull logs.
- 5. **Extra Heavy** - Much cull material requiring falling. Many large, downed cull trees. Area may be swampy or wet. Closely spaced large extra stumps. Thick duff and other organic material.

When payment for slash treatment includes two or more methods, i.e., one for tops and limbs, and another for logs, etc., the following percentages shall be applied for the work as classified above:

TABLE I  
SLASH TREATMENT COMBINATIONS

Clearing Classification	Tops and Limbs (%)	Logs (%)	Stumps (%)
X-Light	30	10	60
Light	30	20	50
Medium	35	35	30
Heavy	40	30	30
X-Heavy	20	40	40

**TABLE II**  
**SLASH TREATMENT COSTS (\$)**

Operation or Method 1/	Vegetation Classification				
	Extra-Light	Light	Medium	Heavy	Extra-Heavy
Clearing	467	626	1,000	1,468	2,000
Grubbing	253	600	940	1,257	1,492
Windrowing Construc- tion Slash 3/	146	231	352	457	573
Windrowing and Covering	242	318	581	808	924
Scattering Construc- tion Slash	116	206	296	412	503
Burying	288	434	682	985	1,202
Chipping	404	555	1,020	1,525	1,778
Piling & Burning 2/	291	422	668	899	1,261
Decking Unmer- chantable Timber	136	171	236	342	482
Disposal in Cutting Units	139	236	337	472	573
Piling in Designated Areas	201	246	442	613	889

*Note: When using Table II, remember to consider the quantitative difference between "clearing" acreage and "grubbing" acreage, and that both items need to be classified separately.*

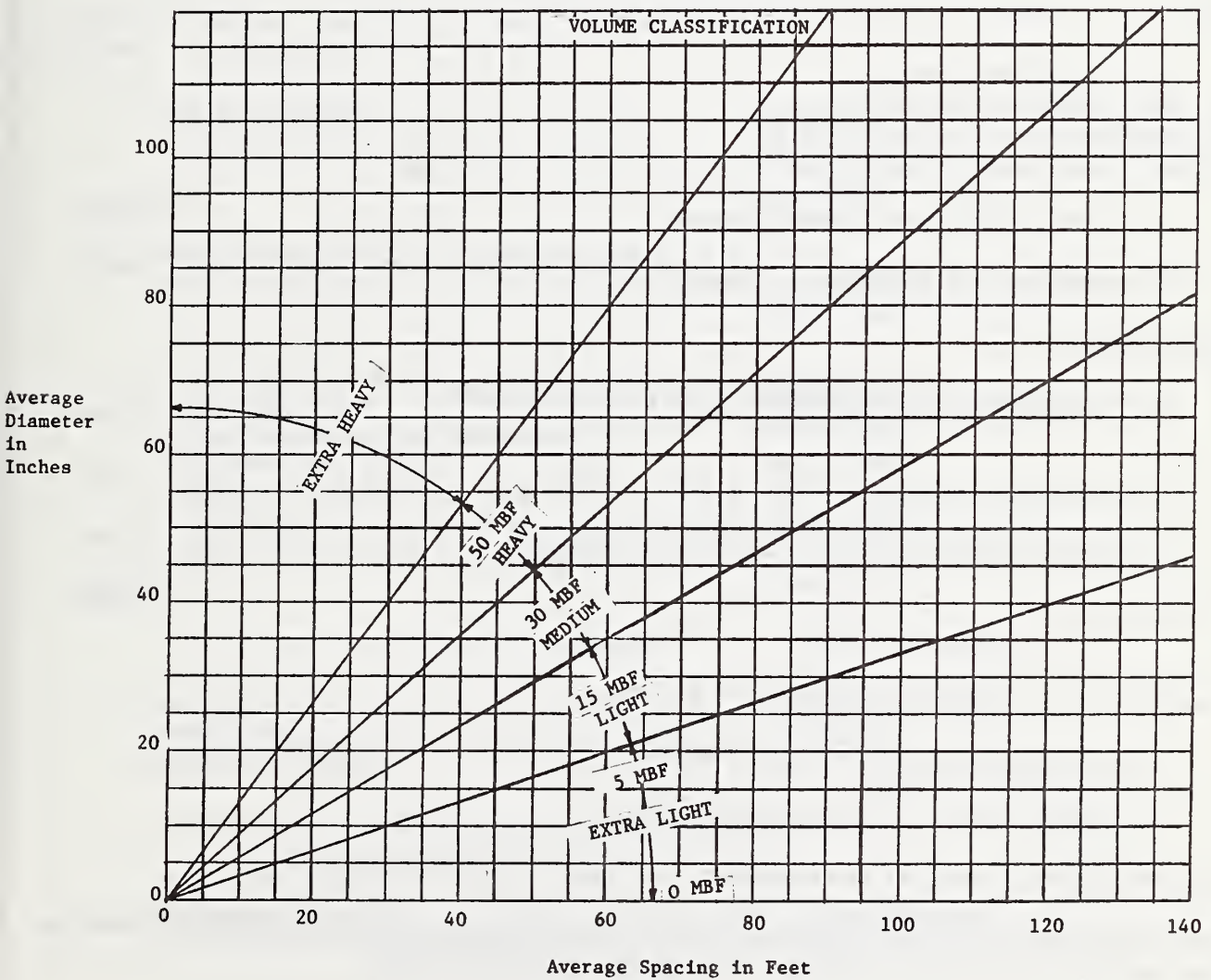
- 1/ Removal costs may need to be added to treatment. Removal costs depend on length of haul to get to disposal site. Use time and equipment methods to calculate costs.
- 2/ Fire protection not included. Use time and equipment method for this cost. Cost will vary depending on the time of year burning will be allowed and the fire plan approved by the Forest Service.
- 3/ Windrow large material is the same cost. Windrow slash on embankment slopes is 1.4 times this cost.

C. **Topographic Factor Correction Table** - This factor should be applied to the combined dollar value for clearing, grubbing, and slash treatment derived from Table I.

**TABLE III**

Ground Slope	Factor
Slack-under 30 percent	0.8
Moderate-30 to 50 percent	1.0
Steep-over 50 percent	1.3
Extra Steep and Rocky	1.5

**FIGURE 0**





D. **Other Costs:** Individual removal of trees and snags will cost from \$20-50 each, depending on the size of the tree, the degree of falling difficulty, and the type of slash treatment required.

If the option "Removal from Government Land" is selected for utilization of merchantable timber, the total cost of the clearing items should be reduced by the net selling value of the merchantable timber. Net value equals selling value minus loading and hauling costs. Fell, buck, and skid costs are allowed for in clearing costs.

#### EXAMPLE PROBLEM

GIVEN:

- 5 Acres of Clearing (Medium Classification)
- 3 Acres of Grubbing (Light Classification)
- Steep Ground Slope: 20% slack, 50% moderate, 30% steep
- Slash Treatment Method:
  - 1. Top and Limbs - Pile and Burn
  - 2. Logs - Windrowing
  - 3. Stumps - Scattering

FIND:

Clearing Cost Per Acre

SOLUTION:

A. **Clearing:** (Table II) \$1,000/acre x 5 acres = \$5,000

B. **Grubbing:** (Table II) \$600/acre x 3 acres = 1,800

Slash Treatment:

C. **Tops & limbs:** (Table II) \$668/acre x 0.35 (Table I) x 5 acres = 1,169

D. **Logs:** (Table II) \$352/acre x 0.35 (Table I) x 5 acres = 616

E. **Stumps:** (Table II) \$296/acre x 0.3 (Table I) x 3 acres = 266

Total Cost = (A + B + C + D + E) = \$8,851

Clearing Acres = \$8,851/5 Acres (clearing) = \$1,770

Apply Topographic Correction Factor (Table III):

$(20\% \times 0.8) + (50\% \times 1.0) + (3.0\% \times 1.3) = 1.05$

COST PER ACRE =  $1.05 \times \$1,770 = \$1,858.71 \approx \$1,860$  (ROUND TO NEAREST \$5)

*Note: Because of the difference in Clearing acres and Grubbing acres, cost must be calculated in a total cost basis and then divided by the Clearing acres to determine COST PER ACRE.*



## SECTION 202 - REMOVAL OF STRUCTURES AND OBSTRUCTION

This item should be estimated on an individual project basis using time and equipment methods. Cost of equipment, labor, disposal, transportation, move-in and move-out of special equipment, etc., should all be considered.

## SECTION 203 - EXCAVATION AND EMBANKMENT

A. **Roadway Excavation** - Many things can affect roadway excavation including special contract requirements, remoteness of the job, and scope of the project.

Base Cost of Materials:

Type	Cost/cu. yd.
Common	\$0.95
Rippable Rock	\$1.90
Solid Rock	\$4.25

B. **Additional Factors:** In addition to the base cost listed above, the following items should be added on, as required, for each project:

1. **Haul** (for excavation) Use the haul charts in Section 205A to increase costs of earth-moving by dozer, towed scraper, wheel tractor scraper, and truck.

2. **Placement Method** (Does not include water)

\$/cubic yard

- |   |               |
|---|---------------|
| 1. Sidecast and end dump                          | None          |
| 2. Layer placement                                | \$0.15 - 0.25 |
| 3. Layer placement (roller compaction)            | \$0.25 - 0.35 |
| 4. Controlled compaction                          | \$0.35 - 0.40 |
| 5. Controlled compaction (density control strips) | \$0.35 - 0.40 |
| 6. Special project (controlled compaction)        | \$0.40 - 0.50 |

Side Slope

\$ per linear foot

- |   |           |        |
|---|-----------|--------|
| 3. <b>Benching 1/</b>                   | 30-50%    | \$0.90 |
| Added when using placement methods 2-6. | Above 50% | \$1.60 |

1/ See "sample benching problem" (page 200-10) for alternate method of computing costs.

4. **Slope Rounding** \$ per linear foot  
\$0.25 - 0.50

5. **Finishing Operations:**

a. **Scarification** (Only required for those sections of unsurfaced roads where the designer anticipates rocks larger than 4" in greatest dimension being present in the top 4" of roadbed. This requirement may be excluded on the Drawings.)

\$/Station (Single Lane)\*

Tolerance class	Light	Medium	Heavy
A	20.66	32.97	56.53
B/C	10.31	27.46	49.45
D/E	7.74	21.95	42.42
F/G	5.18	16.48	35.34
H/I/J	5.18	10.97	28.26

b. **Blade and shape subgrade** (Required on all roads)

\$/Mile (Single Lane)\*

Tolerance Class	A	B/C	D/E	F/G	H/I/J
	1136	758	380	190	190

\*For Double Lane, multiply single lane cost by 1.35

6. **Loading Material** (Into trucks) \$0.50 - 0.75/cu.yd.
7. **Conservation of Rock** \$0.70 - 0.90/cu.yd.
8. **Conservation of Topsoil** \$0.60 - 0.80/cu.yd.
9. **Drilling and Shooting** (For presplitting) \$2.00 - 2.50/lin.ft.
10. **Earth Berms** (Shaped and compacted) \$0.15 - 0.20/lin.ft.
11. **Borrow Excavation** Compute on a time and equipment basis.
12. **Subgrade Treatment** (Filter fabric installed) \$2.00 - 3.00/sq.yd.
13. **Watering** See Section 207 for cost data.
14. **Traffic Control** (Pass traffic during construction)  
\$0.15 - 0.30/cu.yd. (Or develop cost using time and equipment considering down time.)

## SAMPLE EARTHWORK PROBLEM

### GIVEN:

1. 100,000 cu. yds. excavation for a 10 mile job, tolerance class G, medium.
  - a. 70% common material
  - b. 25% rippable rock
  - c. 5% solid rock
2. 50,000 station-yards of haul.
3. 30,000 cu. yds. placement method 2.  
70,000 cu. yds. placement method 4.
4. 100 lin. ft. benching in common material. (Use sample benching problem.)
5. 9,800 lin. ft. of slope rounding.
6. Finishing:
  - a. 15,000 ft. of scarification - single lane.
  - b. 10 miles of blade and shape - single lane.
7. 300 lin. ft. of drill holes for presplitting.
8. 3,215 cu. yds. of gravel borrow in original position (bank yards),  
3,601 loose cu. yds. (See chart I for swell factor)

Placement method 4 - Average haul 2.0 miles.

1.5 miles = 6% favorable gravel road

1.0 miles = 6% adverse dirt road

FIND: Unit cost of roadway excavation and borrow.

### SOLUTION:

1. **Base excavation costs** - 100,000 cu. yds.

Common - 70,000 cu. yds. x \$0.95	\$ 66,500
Rippable - 25,000 cu. yds. x \$1.90	47,500
Solid - 5,000 cu. yds. x \$4.50	22,500
Total Excavation Cost	<u>\$136,500</u>

2. **Short haul cost** using 50,000 sta. yds. of haul with 100,000 cu. yds. of excavation. Divide total haul by total yards to get average haul distance. From Figure 2 (Section 205A) get cost/cu.yd. for short haul. Use Figures 2 or 3 when you average haul distance gets over 300 feet.

$50,000 \text{ sta. yds.} / 100,000 \text{ cu. yds.} \times 100 \text{ ft.} = 50 \text{ ft.}$

From Figure 1, this haul distance falls within the free haul area and no extra cost is allowed.

3. **Placement method**

30,000 cu. yds. x \$0.20/cu. yd.	6,000
70,000 cu. yds. x \$0.38/cu. yd.	26,600

Total Placement Cost	<u>\$52,600</u>
----------------------	-----------------

4. **Benching** - Assume a difficulty of 1.5

970 cu. yds. x \$0.95 x 1.5	\$ 1,383.25
-----------------------------	-------------

5. **Slope rounding**

9,800 lin. ft. x \$0.25/lin. ft.	\$ 2,450
----------------------------------	----------

6. **Finishing:**

a. Scarification - 150 STA x \$16.48/STA	\$ 2,472
b. Blade and Shape - 10 miles x \$190/mi	\$ 1,900

Total Finishing Cost	<u>\$ 4,372</u>
----------------------	-----------------

7. **Drill holes for presplitting**

300 lin. ft. x \$2.25/lin. ft.	\$ 675
--------------------------------	--------

Summation of Excavation Costs:

Excavation	\$136,500
Short Haul	20,000
Placement	32,600
Benching	1,383
Slope Rounding	2,450
Finishing	4,372
Drill Holes	675
Total Cost	<u>\$197,980</u>

Unit Cost = \$197,980/100,000 cy = 19.8 cy



8. **Borrow cost** (Use loose yards for loading and hauling, original position yards for placement.)\*

a. Loading cost -  $\$0.60 \times 3,601 \text{ cu. yds.}$  **\$ 2,160**

b. Hauling cost (From Figure 4 using total haul of 2.0 miles)

1.5 miles on gravel - 6% favorable grade

$\$0.98/\text{cu. yd. mi.} \times 1.5 \text{ miles} = \$1.47/\text{cu. yd.}$

1.0 miles on dirt - 6% adverse grade

$(\$1.48 + 0.06 + 0.12)/\text{cu. yd.} - \text{mi.} \times 1.0 \text{ miles} = \$1.66/\text{cu. yd.}$

Total haul cost =  $\$1.47 + 1.66 = \$3.13/\text{cu. yd.}$

$\$3.13/\text{cu. yd.} \times 3,601 \text{ cu. yds.}$  **\$ 11,271**

c. Placement cost (Method 4)

$\$0.38/\text{cu. yd.} \times 3,215 \text{ cu. yds.}$  **\$ 1,222**

**Total Borrow Cost** **\$ 12,493**

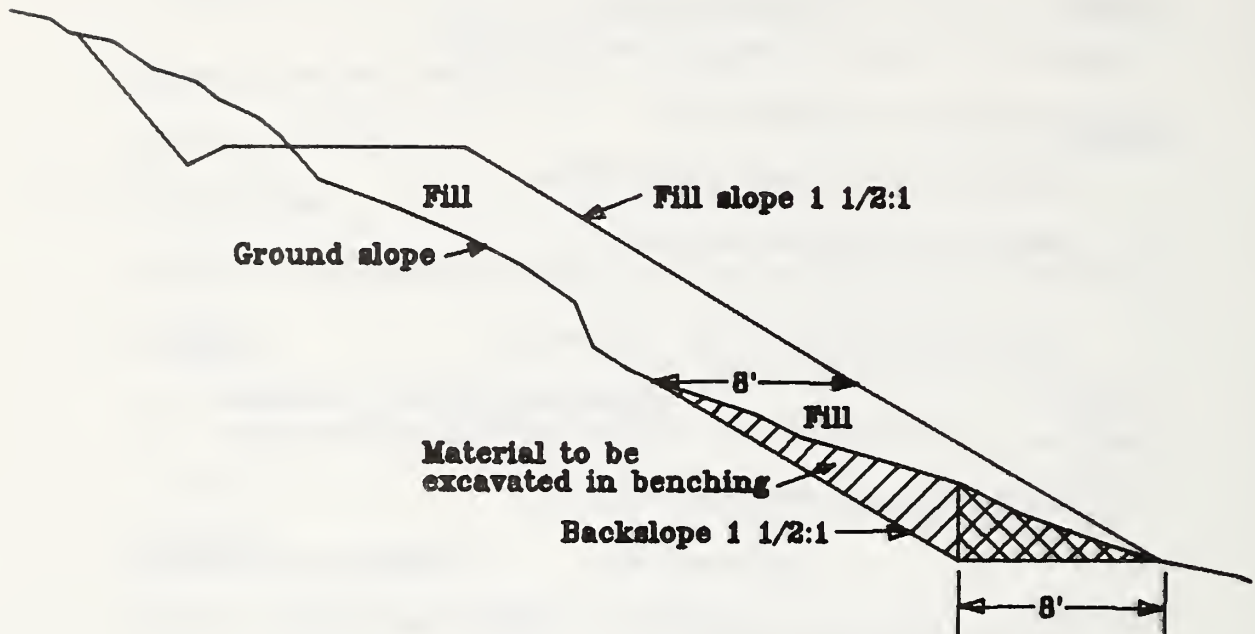
Unit Cost (Borrow) =  $\$12,493/3215 \text{ cy} = \$3.89/\text{cu. yd.}$

*Note: Method of measurement for borrow is in the original position but haul charts and the loading allowance for material are based upon loose measurement. Therefore, a factor must be applied to account for the difference in volumes. Common load swell factors applied to borrow material:*

**Factors of % swell for commonly excavated materials**

Material	% Swell
Sand and gravel	12
Earth, loam	25
Clay	40
Rock, well blasted	65

## SAMPLE BENCHING PROBLEM



### Benching Example:

#### GIVEN:

Sideslope 60%  
Fillslope 1-1/2:1  
Average area - 262 sq. ft.  
Linear feet = 100

FIND: Cubic yards of benching.

#### SOLUTION:

1. Find the average end area of the bench excavation.
2. Divide area by 27 cu. ft./cu. yd. and multiply by 1 lin. ft. This equals cubic yards per lineal foot of bench excavation. Multiply by the lineal feet of bench to determine total cubic yards.

$$262 \text{ sq. ft.} / 27 \text{ cu. ft.} = 9.7 \text{ cu. yd./lin. ft.}$$

$$9.7 \text{ cy/lf} \times 100 \text{ lf} = 970 \text{ cu. yd.}$$

To arrive at benching costs, use the base cost for material to be excavated in that area times a factor that considers the difficulty of access to the areas to be benched (1.5-2.0).

## SECTION 205 - OVERHAUL

Overhaul is difficult to estimate because of varying amounts of "free haul," which must be accounted for in some way. A tractor and blade can efficiently push (haul) dirt about 350 feet. We recommend that you use Section 205A-Haul to account for moving of material an average of more than 300 feet.

## SECTION 205A - HAUL

The cost for excavation or breakout is not included in these costs. The haul costs in Figures 1, 2, and 3, are set up for earth moving by dozer, towed scraper, and wheel tractor scraper. NOTE THAT HAUL COSTS ARE EXPRESSED IN COST/YARD FOR A DISTANCE IN FEET RATHER THAN IN STATIONS.

Make a determination during the design stage as to which type of equipment could be most economically used to move material. This information should be relayed to the cost estimator. Haul grades should be the average grade over a well defined road segment and not broken down into short segments.

Haul volumes and lengths of haul can be computed manually from the mass diagram or may be obtained from the RDS haul program. Determine average haul distances between each balance point to be accurate. If equipment cannot turn around at pickup and deposit points, then you have to account for the extra haul distance.

Figure 4 is set up to compute haul costs for moving excavation, borrow, aggregate, or water by truck. Note that haul costs are expressed in cost per yard-mile or cost per 500 gallon-mile.

## SECTION 206 - STRUCTURE EXCAVATION

Costs for structural excavation in conjunction with bridges should be estimated on an individual project basis. Check with the Bridge Design Section in the Regional Office for help in costing this item.

## SECTION 206A - EXCAVATION FOR CULVERTS AND MINOR STRUCTURES

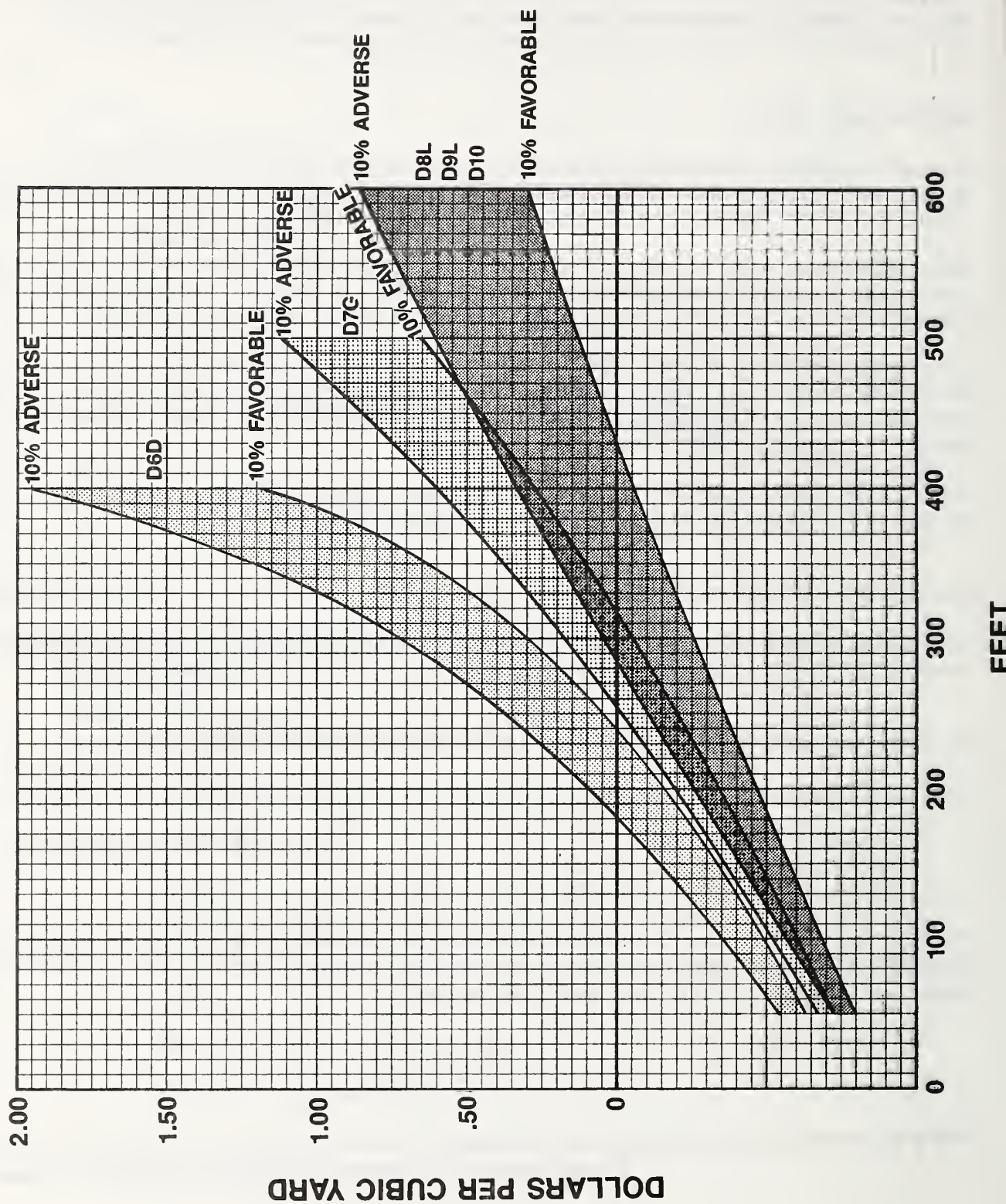
Costs for this section can vary considerably depending on the particular structure, and the soil type.

- |  |                           |
|--|---------------------------|
| 1. Minor Structure Excavation<br>(Cattleguards, retaining walls, etc.) | \$10.00 - \$25.00/cu. yd. |
| 2. Pipe Culvert Excavation   | \$ 6.00 - 12.00/cu. yd.   |

Estimates for special conditions and for excavation of other structures should be made on an individual project basis, considering the time and equipment required.



# EARTH MOVING RATES — DOZER





**EARTH MOVING RATES — LOWED SCHARER (Self Loading)**  
**(for Push Loading Increase Cost by 12%)**

**FIGURE 2**

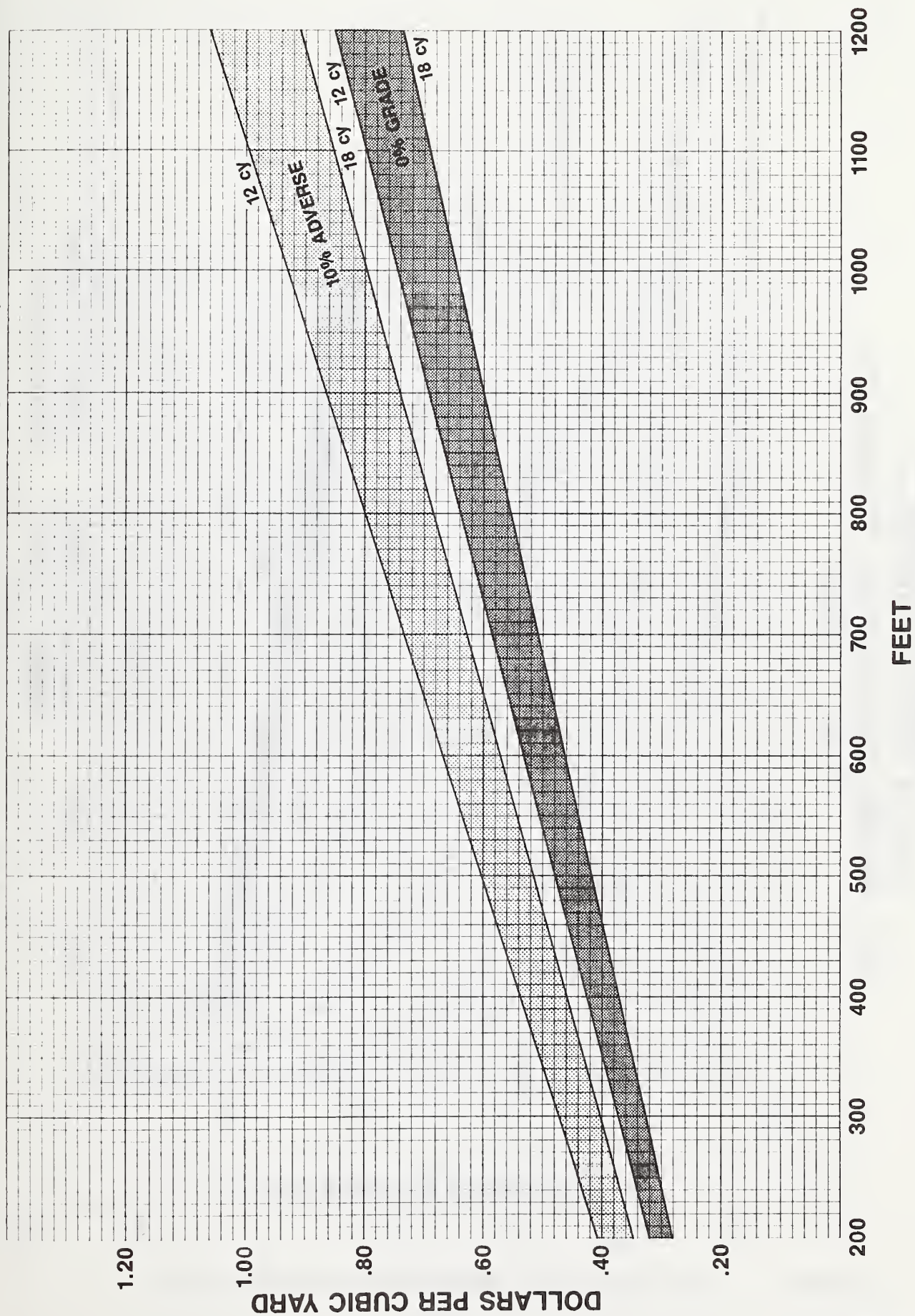
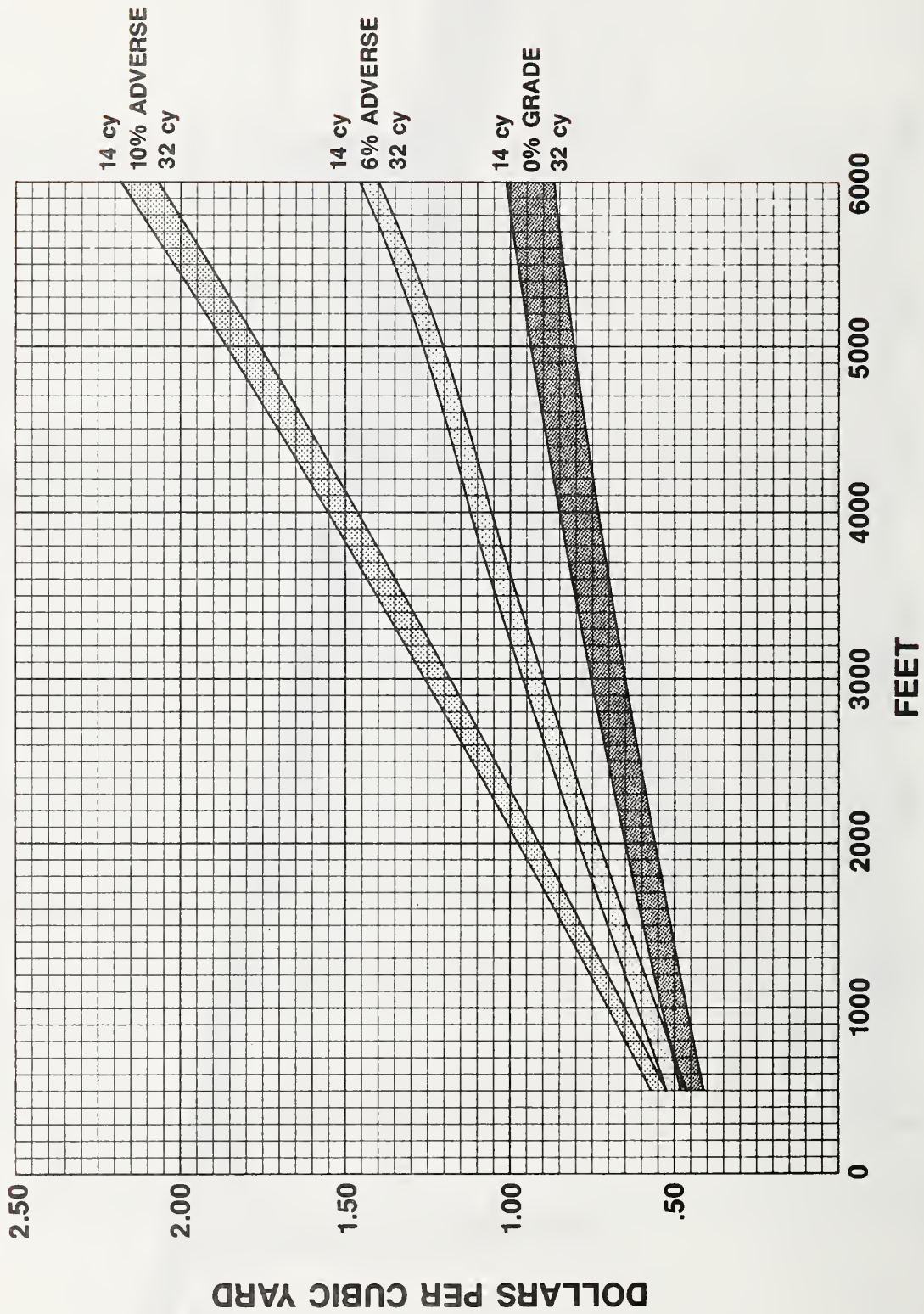


FIGURE 3

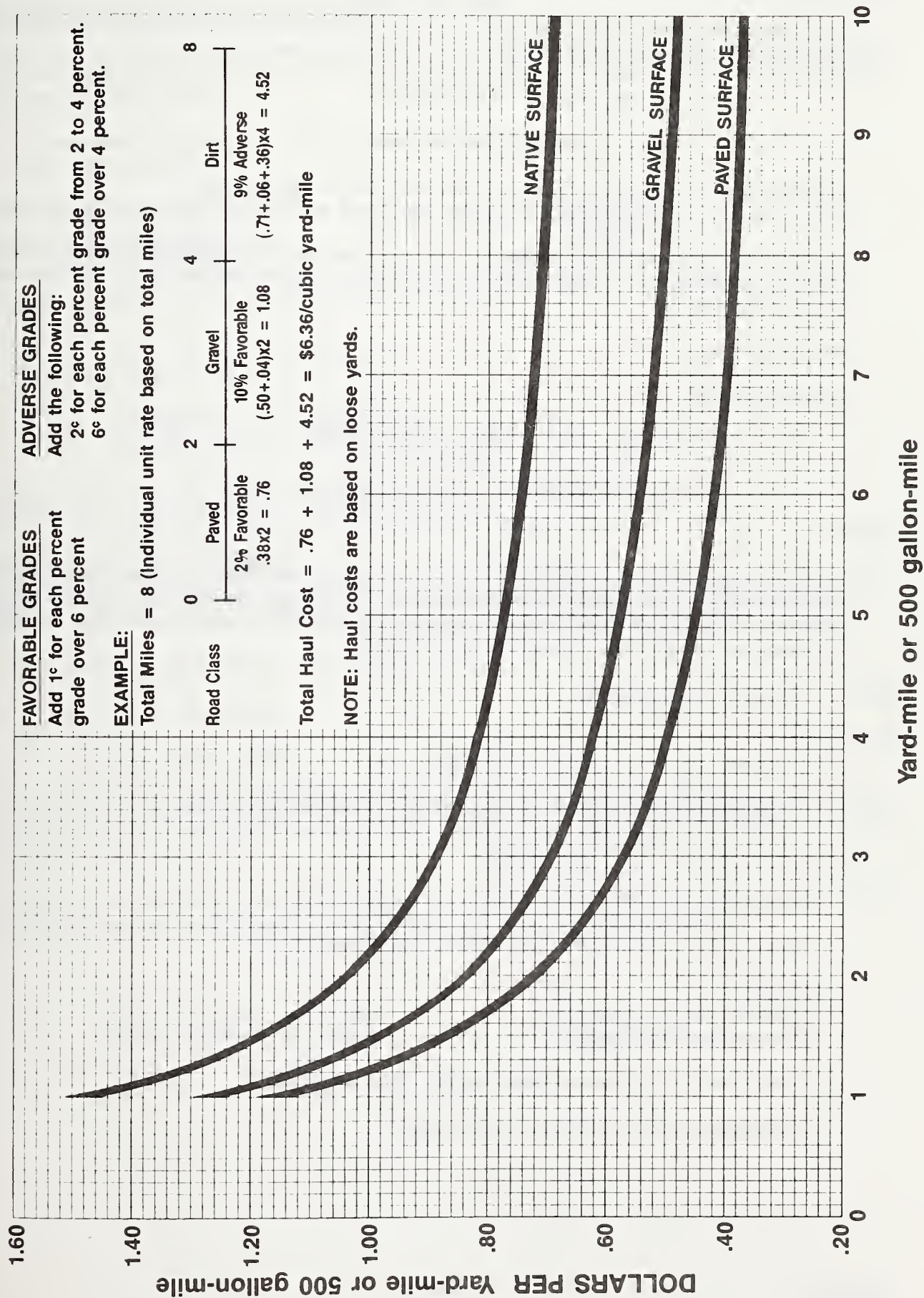
**EARTH MOVING RATES —  
SELF PROPELLED WHEEL SCRAPERS  
(Push Loaded)**





# TRUCK HAUL (Yard-mile or 500 gallon-mile)

FIGURE 4



## SECTION 207 - DEVELOP WATER SUPPLY AND WATERING

- A. **Base Cost** - Use \$8.00 - 14.00/1,000 gallons. The costs include a tank truck and driver, and either a pump or gravity system to fill the tanker.

0 - 100 M-gallon - 11.00/M-gallon

Over 100 M-gallon - 9.00/M-gallon

- B. **Development** - Use \$300 - \$500 if development work such as constructing a large check dam or digging a basin is required. Minor work should be covered under the base cost.

- C. **Haul Cost** - Use Figure 4 to compute haul costs from the source to the center of the project. Note that Figure 4 gives the cost for a 500 gallon-mile; so this unit cost must be multiplied by 2 to arrive at a cost for a 1,000 gallon-mile.

- D. **Sample Problem**

Estimating Quantity

1. Embankment - Use 5-10 gallons per cubic yard.
2. Base and surface courses - Use 20-30 gallons per cubic yard.

GIVEN:

10,000 cubic yards of crushed aggregate is to be placed on a 3.0-mile long road project. There is a water source located 2.0 miles from the beginning of the project. Only minor development work is necessary on the source. Average grade on the project is eight percent adverse, and the grade on the 2.0-mile gravel surfaced haul route is 6 percent adverse.

FIND: Cost per M-gallon of water

SOLUTION:

1. **Quantity Required** - Assume 25 gallons/cubic yard.  
 $10,000 \text{ cubic yards} \times 25 \text{ gallons/cubic yard} = 250,000 \text{ gallons}$   
 $250,000 \text{ gallon}/1000 = 250 \text{ M-gallons}$
2. **Base Cost** - 9.00/M-gallon
3. **Haul Cost** -  $2.0 + 3.0/2 = 3.5$ -mile haul to midpoint of project.

Using Figure 4:

Gravel surface 6% Unfavorable  
Native surface 8% Unfavorable

$$(.83 + .06 + .12) \times 2.0 = 2.02$$
$$(1.18 + .06 + .24) \times 1.5 = 2.22$$

Haul Cost -  $2.02 + 2.22 = 4.24/500$  gallons or 8.48/M-gallon

4. **Total Costs** =  $\$9.00 + \$8.48 = \$17.48/\text{M-gallon}$



## SECTION 210 - OBLITERATION OF ABANDONED ROADWAY

Costs for this item should be estimated using the time and equipment method. Costs will vary, depending on the amount of scarification required, cross-ditching to be done, and drainage structures to be removed. Some typical costs include:

- A. **Scarification** (Average depth of 6"-12" using a D-8 caterpillar and multi-toothed ripper)
  - 1. Single lane gravel road \$ 500/mile
  - 2. Double lane gravel road \$ 800/mile
  - 3. Single lane paved road \$2000 - 4000/mile
- B. **Cross-Ditching** - Add \$45.00/ditch.
- C. **Remove Drainage Structure** (18"-24" pipe)
  - 1. Salvageable - \$10 - 15/foot of pipe
  - 2. Nonsalvageable - \$4 - 5/foot of pipe

## SECTION 299 - COMPOSITE ROAD CONSTRUCTION

(Low Volume Road Construction)

Costs for this item should be obtained by referring to the applicable sections contained elsewhere in this Cost Guide:

**Clearing and Grubbing** - Section 201

**Excavation** - Section 203

**Erosion Control** - Section 625

Apply only those costs associated with the work required by the specification. The specification only requires a finish ordinarily accomplished by a crawler-tractor, therefore, no allowance for blading or shaping the subgrade.

Additional work not included in this specification, such as installation of metal pipe, should be estimated separately and should be designated on the Schedule of Items as a separate pay item.



## **SECTION 300 - BASES**





## SECTION 304 - AGGREGATE BASE OR SURFACE COURSE

These specifications should be estimated on an individual project basis. Costs will vary, depending on the items required for the particular job. In estimating the cost, a determination should be made as to the equipment necessary for an efficient operation.

A. **Base Price** - Produce and load directly from crusher belt. (Estimate for the process needed to produce material which meets the specification.) Prices are based on loose yardage.

1. Crushed = \$4.00/cu.yd.
2. Screened = \$2.10 - \$4.00/cu.yd.
3. Unscreened = \$1.30 - \$1.55/cu.yd.

### B. Add to Base Price as Applicable

- |  |   |
|--|---|
| 1. Royalty charge from private pit.  | Obtain from pit owner.                  |
| 2. Pit development.  | See Section 611.                        |
| 3. Drilling and shooting of quarries (if applicable).  | \$1.50 - \$2.00/cu.yd.                  |
| 4. Ripping costs (if applicable).  | \$0.75 - \$1.00/cu.yd.                  |
| 5. Access road.  | See Section 203.                        |
| 6. Removal or breakdown of oversize material at source.  | \$0.45 - \$0.55/cu.yd.                  |
| 7. Stockpiling (crushed and screened) use only if Contractor is directed to stockpile within the pit area. | \$0.40 - \$0.50/cu.yd.                  |
| 8. Loading from stockpile (do not use if loading directly into trucks from crusher belts).                 | \$0.50 - \$0.75/cu.yd.                  |
| 9. Haul.   | Obtain from haul charts. (Section 205A) |
| 10. Process aggregate on road with grader.   | \$0.40 - \$0.50/cu.yd.                  |
| 11. Process select borrow on road with grid roller to reduce oversize.                                     | \$0.75 - \$1.00/cu.yd.                  |
| 12. Water.   | See Section 207.                        |

- |     |   |                        |
|-----|---|------------------------|
| 13. | Compaction with hauling equipment.                          | \$0.15 - \$0.25/cu.yd. |
| 14. | Compaction with roller (or use time and equipment methods). | \$0.35 - \$0.50/cu.yd. |

*Note: Compaction efficiency will depend on aggregate, gradation, moisture content, and subgrade material. Costs should be estimated on the basis of the number of hours of roller time required. For estimating purposes, the following production rates may be used as a guide:*

#### Rolling

Embankment	-	150-225 cu.yd./hr.
Subgrade	-	1500 sq.yds./hr.
Base Course	-	200-250 tons/hr.
Surfacing	-	Width of roadway in ft/4 will give the approx. number of hrs./mile of roller time required.

15. Crusher Mobilization - Compute costs on a time and equipment basis, considering the following items:

#### a. Move-In and Set-Up

#### Typical Costs

1. Jaw Crusher	\$1,600 - \$ 2,700
2. Two-Stage Crusher	\$4,200 - \$ 5,300
3. Three-Stage Crusher	\$8,400 - \$10,500
4. Allow move-in costs for dozers, loaders, compressors, trucks, scrapers, etc., as needed.	
b. Changing Pit Sites	\$1,400 - \$2,100
c. Changing Screens	\$ 150 - \$ 800
d. Setup Belt-Scale Operation	\$1,100 - \$1,600

### SAMPLE CRUSHED AGGREGATE PROBLEM

#### GIVEN:

12,000 cu.yd. of 1" minus crushed surfacing material is to be placed on a timber sale road. Pit development costs are \$900 (determined by the Time and Equipment Method). Ripping will be necessary.

Haul is 6 miles on a gravel road with a 6 percent adverse grade. It is anticipated that a two-stage crusher will be needed. There will be no royalty charges or access road development costs. Stockpiling is not required.

FIND: Unit costs and total costs.

SOLUTION:

### MATERIAL COST

<b>A. Production Cost</b>		<b>\$/Cu.Yd.</b>
1.	Basic cost (produce and load)	\$4.00
2.	Pit development (if pay item is not included in SECTION 611) \$900/12,000 cu. yds.	0.075
3.	Move-in cost \$ 4,800 / 12,000 (Move-in Cost)/(Total Quantity)	0.40
4.	Access road development (if pay item is not included in SECTION 622 or 203)	---
5.	Drilling and blasting	---
6.	Ripping	0.85
7.	Royalty	---
8.	Stockpiling	---
Production Cost		\$5.33
<b>B. Load and Haul</b>		
1.	Loading from stockpile	---
2.	Haul (\$0.54 + 0.06 + 0.12)/yard mile x 6.0 miles) (Haul Chart-Section 205A)=	\$4.32
<b>C. Processing</b>		
1.	Process aggregate with grader	\$0.45
2.	Compaction with roller	\$0.45
3.	Water	---
4.	Blending of fines 1/	---
Total Processing Cost		\$0.90
<b>D. Total unit costs = Production + load and haul + processing = (\$5.33) + (\$4.32) + (\$0.90) =</b>		
		\$10.55/cu.yd.
<b>E. Total costs = \$10.55/cu.yd. x 12,000 cu. yd. =</b>		
		\$126,600

1/ When addition of filler material is to be accomplished at the source, this cost should be included in the production costs.

## SECTION 306 - RECONDITIONING EXISTING ROAD

Preparing the cost estimate for reconditioning an existing roadbed is sometimes more difficult than for an ordinary construction project. A great deal of individual judgement is needed, especially when the quantities are small. Reconditioning costs can vary greatly from one project to the next because of differing ground conditions. Unit costs cannot always be used because they usually apply to large quantities of work.

Costs should normally be calculated using the Time and Equipment Method and always use the smallest piece of equipment than can economically perform the job. Be sure allowances are made for move-in costs.

Use local costs or construction wage rates (section 150-199) and equipment costs (Section 637) to construct costs for these operations.

1. **Slide Removal** - For small slides (one or two cubic yards), a grader can remove it if the slide is not saturated. For slides larger than two cubic yards, use a front end loader for removal, and if the disposal area is beyond 200 feet, use a dump truck for haul.

Dump truck and operator up to 60 cu. yds. per hour on short haul (under one mile)

1.5 cu. yd. or 2.5 cu. yd. front end loader and operator

2. **Pull Ditches** - Pull ditches with grader and clean catch basins:

Motor grader and operator at 2 hours work/mile

3. **Scarification** - Scarify average depth of two inches: 2/

Motor grader and operator at 4 hours work/mile

4. **Blade Single Lane Road: 2/**

Motor grader, operator, and laborer at 3 hours work/mile

5. **Blade Double Lane Road: 2/**

Motor grader, operator, and laborer at 4 hours work/mile

6. **Compaction: 1/**

Roller and operator at 4 hours work/mile

Water tank truck and operator at 4 hours work/mile

7. **Water Bars:** See Intermountain Region "Technical Guide - Erosion Prevention and Control on Timber Sale Areas" page VI-47, for spacing.

Temporary - Motor grader and operator - 8-10 per hour

Permanent - D8 size crawler tractor and operator - 4 per hour

*1/ Water needs to be added to maintain optimum moisture content in each layer processed.*

*2/ A roadbed full of deep chuckholes and boulders in the subgrade could double the scarification and blading costs.*



## **SECTION 400 - PAVEMENT**



## **SECTION 401 - PLANT MIX BITUMINOUS PAVEMENTS**

Costs for this item should be analyzed by checking local prices and considering the size and remoteness of the project, haul distance, and adequacy of the work site, etc. Refer to local suppliers or check with the Materials Section in the Regional Office for determining costs on most projects.

## **SECTION 403 - HOT BITUMINOUS PAVEMENT**

Costs for this item should be analyzed considering local prices, remoteness of project, size of project, haul distance of materials, adequacy of work site, etc. Refer to local suppliers for determining costs on most projects. Check with the Materials Section in the Regional Office before starting any major project.

The following prices are given as a guide for rough estimating purposes:

1. Bituminous Mixture - \$15.00/ton.
2. Asphalt Cement - Check Asphalt Cost Data (Table II).

## **SECTION 404 - COLD BITUMINOUS PAVEMENT**

Cost estimates for this item should be analyzed considering remoteness of project, size of project, haul distance of materials, adequacy of plant work area, etc. Move-in and move-out costs for a pugmill-type mixer are about \$2,600 to \$3,200.

The following prices are given as a guide for rough estimating purpose:

1. Bituminous Mixture - \$15.00/ton.
2. Bituminous Material - Check Asphalt Cost Data (Table II).

## **SECTION 405 - ROAD MIX BITUMINOUS PAVEMENT**

Cost for this item could vary considerably depending on the particular job. Check with the Materials Section in the Regional Office before beginning any major project.

A. **Aggregates** - Use appropriate costs developed in Sections 304 and 611.

B. **Bituminous Material**

1. Materials Cost - See Table II.
2. Haul Cost - Check with the Asphalt Producer listed in Suppliers at end of chapter.

C. **Blade Processing, Pugmill, and Traveling Mixer** - use time and equipment or contact Materials Engineer in Ogden.

## **SECTION 406 - HOT BITUMINOUS PLANT MIX (COMMERCIAL SOURCE)**

This item should be estimated on an individual project basis. Costs will depend on size and remoteness of project, haul distance of materials, adequacy of work site, etc. Contact commercial sources in your area for the latest cost information.

- A. **Bituminous Material** - See Table II.
- B. **Hot Bituminous Plant Mix** - \$16.00 - \$30.00/ton (Includes aggregate, mixing and moderate haul.) Use Section 304 to develop more precise aggregate and haul costs.

## **SECTION 407 - TACK COAT AND SECTION 408 - PRIME COAT**

### **CONSTRUCTION COSTS**

#### **A. Bituminous Materials**

- 1. **Asphalt Cost** - See Table II.
- 2. **Haul** - Check with the Asphalt Producer listed in Suppliers at end of chapter or the Materials Engineer in Ogden for the latest haul rates for your particular job. Haul rates may vary from state to state, and Interstate hauls may cost up to 25 percent more than Intrastate hauls.
- 3. **Demurrage** - Check with the Asphalt Producer or the Materials Engineer in Ogden for the demurrage cost on your particular haul.
- 4. **Application Cost with Distributor** - Check with the Asphalt Producer or the Materials Engineer in Ogden for the latest cost information. Costs have fluctuated greatly during the past two or three years.

#### **B. Surface Preparation TACK COAT - SECTION 407**

- 1. **Power broom or blower to clean road surface prior to application of prime coat.**
  - a. Under 10,000 sq. yds./project - \$0.04 - \$0.05/sq. yd.
  - b. Over 10,000 sq. yds/project - \$0.02 - \$0.04/sq. yd.
- 2. **Repair Chuck Holes** - Figure on a time and equipment basis, depending on the condition of your particular road.

#### **B. Surface Preparation PRIME COAT - SECTION 408**

- 1. **Blade and Shape Road** - use time and equipment see Section 306.
- 2. **Blotter Material (If necessary)** - \$6.20 to \$8.25/ton.

## **SECTION 410 - BITUMINOUS SURFACE TREATMENT AND SEAL COAT**

### **CONSTRUCTION COSTS**

#### **A. Aggregates**

- 1. **Crust and Stockpile** - See Section 304 and 611.



2. Spreading, Rolling, Blading, and Maintenance - \$0.10 to \$0.25/sq. yd.

**B. Bituminous Material**

1. Asphalt Cost - See Table II.
2. Haul - Check with the Asphalt Producer or the Materials Engineer in Ogden for the latest haul rates for your particular job. Haul rates may vary from state to state.
3. Application Cost with Distributor - check with the Asphalt Producer or the Materials Engineer in Ogden for the latest cost information. Cost fluctuate greatly each year.
4. Demurrage - Check with the Asphalt Producer or the Materials Engineer in Ogden for the cost on your particular haul.

**SECTION 412 - BITUMINOUS DUST PALLIATIVE TREATMENT**

Use the cost data below to estimate costs for this specification. The dust oils listed in Table I can be used along with some other asphaltic materials that can be recommended by the Regional Materials Engineer.

The road surface must be carefully prepared to ensure optimum performance of the dust oil. The surface must be bladed and shaped to produce a smooth, crowned, and well drained surface.

The moisture content of the road surfacing is critical in the top two inches if good oil penetration is to be achieved. The moisture content should be three to five percent. Dust oils usually require a repeat application.

- A. **Roadway Preparation** - Blade and shape road - use time and equipment, see Section 306.
  - B. **Material Cost** - See Asphalt Product Cost Data Chart (Table II).
  - C. **Haul Costs** - Check with the Asphalt Producer or the Materials Engineer in Ogden for the latest haul rates for your particular job. Haul rates will vary from state to state, and Interstate hauls may cost up to 25 percent more than Intrastate hauls.
  - D. **Demurrage** - Check with the Asphalt Producer or the Materials Engineer in Ogden for costs.
  - E. **Application Cost with Distributor** - Check with the Asphalt Producer or the Materials Engineer in Ogden for the latest cost information. Costs have fluctuated greatly during the past two or three years.
1. Conversion Factors - Check with the Asphalt Producer for the weight of oil you are using.

Example: MC 70 Asphalt

- a. One gallon of MC 70 Asphalt weights about 7.9 pounds.
- b. One ton of MC 70 Asphalt contains about 253 gallons.
- c. One truck-tanker and trailer hauls about 25 tons or 6,325 gallons of MC 70 Asphalt.

## 2. Frequently Used Asphalt Application Rates

### a. Crushed gravel surfacing

1. New gravel - 0.3 to 0.5 gallons/square yard.
2. Gravel-oiled the previous year and oil not set up - 0.1 to 0.2 gallons/sq. yd.

### b. Select borrow surfacing

1. Loose material with low binder content - 0.4 to 0.5 gallons/square yard.
2. Compacted with high clay binder - 0.2 to 0.3 gallons/square yard.

### c. Dirt road

1. Clay soil - 0.2 to 0.4 gallons/square yard.
2. Silt soil - 0.3 to 0.5 gallons/square yard.

## 3. Frequently used enzyme application rates.

### a. Full treatment-road building, lake pond sealing:

One gallon per 15 cubic yards of material. Product works best if aggregate or base has approximately 15% nongranular fines or is considered a dirty mixture. At this application rate, a 1 mile long, 25' wide, 6-inch deep treatment would require 165 gallons of enzyme product. Water is required for dilution and dispersal. The cost of water is not included in the price listed in Table II and should be estimated using Section 207.

### b. Mist application:

1 gallon per 1,000 gallons of water. Use this mixture while laying and compacting aggregate on hot days, prior to an asphalt overlayment, and doing subsequent road bladings.

## EQUATION FOR GALLONS OF ASPHALT REQUIRED PER MILE

$$Q = 586.6 \times W \times R$$

Where:

Q=Quantity of asphalt required, in gallons per mile

R=Rate of application, in gallons per sq. yd.

W=Width of application, in feet

Example: What quantity of asphalt is required in gallons per mile when the application rate is 0.3 gallons per square yard and the traveled way is 12 feet?

$$Q = 586.6 \times 0.3 \times 12 = 2112 \text{ gallons per mile}$$

## EQUATION FOR TONS OF AGGREGATE REQUIRED PER MILE

$$T = 0.293 \times P \times W$$

Where:

T=Tons of aggregate required per mile

P=Spread rate of aggregate, in Pounds per square yard

W=Width of application, in feet

Example: How many tons of aggregate are required per mile when the spread rate is 40 pounds per square yard and the traveled way plus shoulder is 14 feet?

$$T = 0.293 \times 40 \times 14 = 164 \text{ tons per mile}$$

TABLE I

 ASPHALT GENERAL DATA  
 WEIGHT AND GALLONS CONVERSION

					Load Temp #		Spread Temp #	
	Gals. Per ton	Bbls. Per ton	Lbs. Per gal.	Lbs. Per bbl.	Nor- mal °F	Max- imum °F	Min- imum °F	Max- imum °F
RC-800	244	5.81	8.19	344	200	250	200	250
RC-3000	240	5.71	8.30	349	225	250	230	250
MC-30	257	6.13	7.77	326	150	175	85	175
MC-70	253	6.02	7.90	332	150	175	120	175
MC-250	248	5.9	8.06	339	175	225	165	225
MC-800	244	5.81	8.19	344	200	250	200	250
MC-3000	240	5.71	8.30	349	225	250	230	250
SC-70	242	5.76	8.25	347	175	200	120	200
SC-250	250	5.71	8.33	350	200	225	165	225
SC-800	238	5.66	8.41	353	225	250	200	250
AC-60/70	232	5.54	8.60	361	325	350	295	350
AC-85/100	233	5.56	8.58	360	325	350	280	350
AC-120/150	233	5.56	8.56	360	325	350	270	350
AC-5	234	5.59	8.53	358	325	350	280	350
AC-10	233	5.56	8.57	260	325	350	280	350
AC-20	233	5.54	8.59	361	325	350	295	350
AR-2000	233	5.56	8.57	360	325	350	280	350
AR-4000	232	5.54	8.60	361	325	350	295	350
CRS-1	240	5.71	8.33	350	100	130	75	130
CRS-2	240	5.71	8.33	350	120	160	110	160
CMS-2	240	5.71	8.33	350	100	130	75	130
CSS-1	240	5.71	8.33	350	100	130	75	130
CSS-1H	240	5.71	8.33	350	100	130	75	130
Clarified (D04)	1007 225	5.36	8.88	373				

## SUPPLIERS

- |  |  |  |
|--|--|--|
| 2- KOCH MATERIALS<br>Bountiful, UT<br>(801) 292-1434   | 5- MONTANA REFINERS<br>Great Falls, MT<br>(406) 761-4100   | 4- CHEVRON USA<br>Portland, OR<br>(503) 221-7811         |
| 3- PHILLIPS PETROLEUM<br>Salt Lake City, UT<br>(801) 263-9516  | 8- KOCH MATERIALS<br>Boise, ID<br>(208) 345-2538   | 7&8- IDAHO ENZYMES, INC.<br>JEROME, ID<br>(208) 324-3642 |
| 6&7- WIDCO INC.<br>GOLDEN BEAR DIVISION<br>Bakersfield, CA<br>(805) 393-7110<br>Las Vegas, NV<br>(702)361-8635 | 1- HILL BROTHERS CHEMICAL CO.<br>3760 S. Highland Drive<br>Suite 246<br>Salt Lake City, UT 84106<br>(801) 273-3911<br>Plant - Rowley, UT |  |



TABLE II

ASPHALT, DUST ABATEMENT, AND ENZYME PRODUCTS COST DATA  
\$ PER TON

SUPPLIER	1	2	3	4	5	6	7	8
PRODUCTS	FOB Rowley Utah	FOB Bountiful Utah	FOB Salt Lake City Utah	FOB Portland Oregon	FOB Great Falls Montana	FOB Bakersfield California Nevada	FOB Las Vegas Idaho	FOB Boise
Asphalt Cement								
85-100					110			160
120-150					110			160
AR-2000				120		125	151	
AR-4000				120		125	151	160
AR-8000				120		125	151	
AC-5			109					160
AC-10			109					160
AC-20			109					160
Liquid Asphalt								
MC-30			135		120			175
MC-70			135	160	120	150	181	175
MC-250			135	150	120	150	181	175
MC-800			135	150	120	150	181	175
MC-3000			135	150	120	150	181	175
SC-70			135		120	135	171	175
SC-250			135		120	135	171	175
SC-800			135		120	135	171	175
Emulsions								
CSS-1		131	105	100	110		165	125
CSS-1		131					165	
CRS-1			100	110			125	
CRS-2		110	105					125
CMS-2				105	110			125
Special Products								
Clarified Dust Oil					90			
Dust Guard								
Magnesium Chloride 1/		30						
Calcium Chloride 2/	25							
Reclaimite		414						
Rubber Crack Sealer		414						1.50/gal
Rubberized products:								
LM CRS-2		150						
Perma-zyme							\$16/gal*	\$13/gal*

Note: Prices are subject to fluctuation. Check with the supplier or contact Materials Engineering in the Regional Office at the time the estimate is being prepared for a current price. Costs are on a per ton basis unless otherwise stated. Emulsions are usually diluted when used as a dust oil. The prices shown are for the undiluted product.

\* Nevada price good for Nevada. Boise price good for Idaho, Utah, and Wyoming. Product may be shipped from Las Vegas, NV or Jerome, ID without change in indicated price by job site state.

1/ 30% solution

2/ 38% solution



## **SECTION 500 - BRIDGE CONSTRUCTION**



**SECTION 550 - BRIDGE CONSTRUCTION**

Contact the Bridge Design section in the Regional Office to estimate the costs of bridges.





## **SECTION 600 - INCIDENTAL CONSTRUCTION**



## SECTION 601 - MOBILIZATION

**Mobilization** is more than just move-in/move-out. By definition, it comprises the movement of personnel, equipment, supplies, and incidentals to the project site. Included would be establishment of field offices, buildings, and other facilities need to proceed with project work. **Bonding** - 1 percent, **insurance**, **interest**, **planning**, and **overhead** - 1 percent, **equipment movement** - 1 percent, **labor** and **supervision** - 1 percent, and **profit** and **risk** - 1 percent, can make up an average of 5 percent of the total project cost. Fire prevention activities need to be added on for the total sum. The cost estimate for the mobilization item can be developed by considering all of the above items independently and then totalling them for one lump sum value or by assigning a percent value against the total job estimate. In most cases, a detailed breakdown of mobilization elements should not be necessary.

Average bids reflect that mobilization costs are 6 percent to 10 percent of the total project cost. Smaller projects tend to show mobilization as a higher percentage of the total project cost. The number of move-ins and operating seasons will increase this percentage. Listed are normal percentages for mobilization.

\$ 50,000	-	\$ 600,000	=	9%
600,000	-	899,999	=	8%
900,000	-	1,999,999	=	7%
1,200,000	-	over	=	6%

These percentages consider a normal project to have two construction seasons. If specialized pieces of equipment or machines are required, the percentage should be increased.

### Roading Costs:

Roading costs can be used for time and equipment jobs, particularly for reconstruction projects. The method for calculating these types of move-in costs would be to determine the time to move to the project site and begin productive operation, then affix proper standby rates, usually 45 to 55 percent of listed rental rates, plus wage rates. For projects of this type and others where mobilization can be readily figured in as an integral part of the listed pay item, it may be unnecessary to include a separate mobilization pay item in the contract. Average roading costs are listed below for some standard equipment:

	Cost per mile
1. Graders, Motor Patrol	\$3.05
2. Loaders, 1-4 cubic yards	3.60
3. Dump Trucks, 10-12 cubic yards	1.20
4. Water Trucks	2.25
5. Trucks, Fire, Small Dump, etc.	1.20
6. Lowboy	
20-35 tons	1.25
35-50 tons	2.10

*Note: Bonding has been removed from this section. Payment for bonds on Public Works Projects is a separate allowance given on the first progress payment. Timber sales do not require bonding on road construction.*

## SECTION 603 - METAL PIPE

**A. Culvert Pipe Cost Per Lineal Foot** - Costs vary throughout the Region. Check with local suppliers and consider discounts for large quantities. Material prices are based upon galvanized steel which is the least expensive material available at the time of this publication. Prices also reflect a discount for orders by the truckload (approx. 1,000 lin. ft.) and include delivery to the job site. The following factors should be applied to material costs only for small orders:

Under 500 lin. ft. - 1.25

500 - 1,000 lin. ft. - 1.1

### Suppliers:

Spokane Culvert Company  
4778 Dorman  
Boise, ID 83705  
(208) 344-2570

Valley Steel Builders  
Armco Dealer  
10621 Executive Dr.  
Boise, ID 83704  
(208) 376-0662

Kaiser Aluminum  
303 Wash. Mutual Blvd.  
Spokane, WA 99201  
(509) 624-4186

Contech Const. Products  
1935 N. 900 W.  
Salt Lake City, UT 84116  
SLC (801) 363-3873  
Boise (208) 376-0662  
Idaho Falls (208) 522-1713

Syro Co.  
Centerville, UT 84014  
(801) 292-4461  
(Structural Plate and  
Guardrail)

Intermountain Piping Sys.  
2270 N. 640 W.  
West Bountiful, UT 84010  
(801) 298-9696  
(Polyethelene Pipe)

Costs for labor, equipment, and material for pipe culverts 36" and smaller in diameter and for CMPA's 42" x 29" and smaller are included in the following table.

Size	New Construction	"After Grade" & Reconstruction (Shallow Installation)
15"	\$14.50/ft.	\$15.95/ft.
18"	15.25	16.80
24"	19.50	21.65
30"	25.00	27.75
36"	28.50	32.70

For an aluminum multiply new construction price by 1.25 and "after grade" price by 1.23.

Estimate larger pipes by time and equipment methods. Following are some items that should be considered under Item 603 and 206A when estimating installation of larger pipes:

1. Analyze the cost of materials for different culvert corrugations. Often less metal thickness can be used with the wider corrugations which may result in a savings in materials costs.
2. Allow costs for metal end sections, culvert end treatments, shop ellipsing, asphalt coating, and adjustment for pipe arches if required.
3. Estimate the amount of time and equipment required (excavation equipment, compaction equipment, labor, operators, etc.) to excavate and construct the culvert bed including excavation below the invert elevation for removal of unsuitable or unstable material and to bed and backfill the pipe (compaction method B). Allow time for diversion of the stream and cost for special materials or equipment needed for diversion such as plastic sheeting, piping, pumps, etc.
4. If springs, seeps, or underground flows are expected in the culvert area allowance should be made for filter cloth, drain rock, cutoffs, special bedding, or special backfill material as required.



The following materials and shop prices are provided as a guide for use in estimating culvert prices (based on truck load quantities). Local suppliers' prices and discounts may be substituted, if available.

**Culvert material base price:**

**Galvanized Metal - 2.66" x 1/2" corrugations**

Thickness	0.064		0.079		0.109		0.138	
Gage	16		14		12		10	
Size	Cost	Wt/Ft	Cost	Wt/Ft	Cost	Wt/Ft	Cost	Wt/Ft
12	4.83	10	6.19	12				
15	5.98	12	7.62	15				
18	7.16	15	8.99	18				
24	9.47	19	11.99	24	16.77	33		
30	11.80	24	14.83	30	20.80	41		
36	14.11	29	17.76	36	24.88	49		
42	16.44	34	20.68	42	29.00	57		
48	18.73	38	23.57	48	33.06	65	42.70	82
54			26.49	54	36.36	73	47.35	92
60			29.44	60	40.13	81	51.90	103
66					44.09	89	57.45	113
72					48.06	98	62.15	123
78					53.08	105	68.70	133
84							73.21	144
90							78.71	154
96							84.27	165

**Galvanized Metal - 3x1 corrugations**

Thickness	0.064		0.079		0.109		0.138	
Gage	16		14		12		10	
Size	Cost	Wt/Ft	Cost	Wt/Ft	Cost	Wt/Ft	Cost	Wt/Ft
42	23.25	39	29.25	47				
48	26.51	44	33.34	54				
54	29.35	50	37.47	61	51.07	83		
60	32.38	55	41.65	67	56.37	92		
66	35.59	60	45.05	74	61.93	101		
72	38.79	66	49.11	81	67.50	110	90.56	140
78	42.85	71	51.32	87	74.68	119	97.98	152
84	46.22	77	58.49	94	80.44	128	105.42	164
90	49.43	82	62.55	100	86.61	137	112.84	175
96	52.63	87	66.61	107	92.23	147	120.27	188
102			70.24	114	97.26	155	129.70	198
108			74.31	120	102.87	165	135.14	211
114			77.65	127	108.19	174	142.56	222
120					113.51	183	150.00	234
126					132.61	195	168.66	248
132					138.73	204	176.13	259
138					144.85	213	185.66	273
144					151.65	223	191.78	282

**Coupling Bands, equivalent cost:**

7" wide - same as 1.5' of pipe

12" wide - same as 2' of pipe

24" wide - same as 3' of pipe

**Arch & elliptical pipe prices need to be increased by the following factors:**

Less than 30' one diameter + 40%

30' - 100' one diameter + 25%

greater than 100' one diameter + 15%

**B. Culvert pipe and treatment (does not include material).**

Diameter or equivalent Span & Rise	Price per cut (skew or bevel)	Diameter or equivalent Span & Rise	Price per cut (skew or bevel)
18"	54.98	48"	171.58
24"	83.17	54"	192.05
30"	102.14	60"	212.58
36"	130.50	66"	233.06
42"	151.03	72"	253.58

**C. Five percent shop ellipse: (Same cost additions as for arch pipe).****D. Asphalt Coating:**

Add \$0.20/inch of diameter per foot. If less than 10 tons of culvert, allow \$600 for a setup charge plus \$0.22 per inch of diameter per foot.

E. End Sections (Flared inlets) Average Material Costs:

Diameter or Dimensions of		Galvanized		Asphalt Coated		Toe Plate Extension Price		
Arch	Gage	Price	Weight	Price	Weight	Loose	Attached	Weight
12	16	43.62	28	50.07	35	5.63	12.44	6
15	16	54.74	36	62.83	45	6.88	14.37	7
18	16	70.06	50	80.42	62	7.55	15.81	7
24	16	101.24	76	122.01	93	9.33	19.35	9
30	14	202.00	157	233.62	186	13.65	26.21	13
36	14	307.00	209	351.95	246	20.75	36.09	17
42	12	524.21	430	590.56	485	29.16	39.47	27
48	12	615.56	509	706.55	578	36.84	62.97	29
54	12	732.66	630	840.96	715	38.72	73.51	32
60	12/10	1,075.00	826	1,233.89	926	42.27	82.35	35
66	12/10	1,181.71	914	1,356.41	1029	43.75	91.27	36
72	12/10	1,329.30	998	1,525.76	1164	50.96	107.40	38
78	12/10	1,409.35	1108	1,617.67	1326	52.16	115.58	40
84	12/10	1,472.47	1200	1,690.14	1488	52.75	124.86	42
17x13	16	59.40	30	68.19	39	6.42	13.88	5
21x15	16	67.85	37	77.88	49	7.55	15.87	7
28x20	16	99.02	60	113.66	77	9.33	19.35	9
35x24	14	169.44	109	194.49	138	13.72	26.33	13
42x29	14	291.17	165	334.21	202	19.65	34.92	16
49x33	12	436.85	276	501.44	331	30.26	51.69	27
57x38	12	536.98	361	616.35	430	37.44	64.02	30
64x43	12	630.07	520	723.22	605	39.95	73.84	38
71x47	12/10	778.39	790	893.94	890	44.21	84.29	39
77x52	12/10	1,145.36	818	1,314.16	928	54.71	95.69	55
88x57	12/10	1,239.37	887	1,422.58	997	57.23	101.90	59

## SECTION 603B - CORRUGATED POLYETHYLENE PIPE (material price):

12" - \$ 3.50/ft.

15" - \$ 4.75/ft.

18" - \$ 5.50/ft.

24" - \$ 9.25/ft.

\* 30" - \$16.50/ft.

\* 36" - \$21.52/ft.

\* Smooth wall

### EXAMPLE PROBLEM:

#### GIVEN:

New construction project with 15 pipe installations of about 40 feet each. Total length is 600 feet of 16 gage, 18 inch diameter galvanized metal pipe. A 5% ellipse and beveled ends are required on all 18 inch pipes.

**FIND:** The adjusted cost per lineal foot.

#### SOLUTION:

- a. Standard material and installation cost:

$$\$15.25 - \$7.16(\text{material}) = \$8.09(\text{installation})$$

- b. Adjustment to material cost:

$$\$7.16 \times 1.1(\text{small amount}) \times 1.15(\text{ellipsing}) = \$9.09/\text{L.F.}$$

- c. End treatment:

Assume one cut to provide bevel for both ends.

$$15 \times \$54.98 = \$825$$

- d. Adjusted total and per foot cost:

$$\text{Adjusted material and installation cost} = \$9.06 + 8.09 = \$17.15$$

$$\text{Subtotal M and I} \quad 600 \text{ feet} \times \$17.15 = \$10,288$$

$$\text{Subtotal cut end treatment} = \$825$$

$$\text{Total adjusted cost} = \underline{\$11,113}$$

$$\text{Average per foot cost} \quad \$11,113/600 = \$18.52$$

## SECTION 604 - MANHOLES, INLETS, AND CATCH BASINS

Contact manufacturers for cost of specific items and use time and equipment methods to arrive at installation costs for this item.



**SECTION 605 - UNDERDRAINS** (See Section 720 for other Underdrain Products)

**A. Perforated Pipe Cost Per Lineal Foot:**

Diameter	Thickness Galvanized	Galvanized 1/	Installation Cost
6"	.064	3.00	7.25
8"	.064	3.30	7.75
10"	.064	5.22	8.00
12"	.064	5.00	8.50
15"	.064	6.20	9.50
18"	.064	7.40	9.75
24"	.064	9.70	10.00

1/ For Aluminum multiply by 1.5

**B. Special Sections:**

	Elbows (0-45)		Wyes & Tees	
Diameter	Install Each	Materials	Install Each	Materials
6 in.	\$7.25	32.09	\$7.60	\$33.70
8 in.	7.75	44.40	9.00	46.62
10 in.	8.00	53.75	10.00	56.44
12 in.	8.50	63.17	11.75	66.33
15 in.	9.50	75.04	13.15	78.79
18 in.	9.75	94.30	13.50	99.02
24 in.	10.00	119.70	13.80	125.70

**C. Porous Backfill (Filter Material):**

Develop price from rock costs plus the haul cost, as determined from the haul chart. Haul costs should be estimated from the nearest point of manufacture.

**D. Plastic Filter Cloth** - Check Section 720 for prices.

**F. Granular Underdrain**

The cost of granular underdrain is normally figured on a cubic yard basis which includes cost of production, loading, hauling, spreading and compaction. Develop cost by using same criteria as used in SECTION 304 - AGGREGATE BASE OR SURFACE COURSE.

**SECTION 606 - GUARDRAIL**

The length of guardrail should be determined by a slope distance rather than a centerline measurement. In addition, the total length of rail on both sides of the road must be figured.

**Rail Elements** - Price each: (FOB SLC, Ut.)

12-1/2' Rail Element				25' Rail Element	
Gage	Type	Per Rail	Per Foot	Per Rail	Per Foot
12	W-Beam or Flex Beam	\$50.00	\$4.00	\$100.00	\$4.00
10	W-Beam or Flex Beam	\$62.50	\$5.00	\$125.00	\$5.00
	Concrete Barrier	\$275.00	\$22.00		

**Fasteners and Accessories:**

Round head oval shoulder type bolts with nuts, each (ave.) - Bolts run from \$0.60 for 5/8" x 1-1/4" to \$2.50 for 5/8" x 24".

Backup Plate                      Type 1, 12 gage @ \$3.00 each

**Terminal Sections** - price each:

End Shoes              12 Gage Standard              \$25.00

**Fabrication Extra for Curving:**

Add \$2.50 per foot to the standard rail price.

**Posts:** 8" x 8" x 5'4", set @ 6'3" centers, treated with penta, creosote, or copper naphthanate.

Regular	Free of Heart Center	Glue-laminated
\$23.90	\$38.10	\$31.25

**Cor-Ten Steel:** 1.4 times price of galvanized steel.

**Concrete Barrler:** Price includes pins and is based on truckload price. One-way haul over 130 miles is extra.

## SECTION 607 - FENCES, GATES, AND CATTLEGUARDS

Fences and gates should be estimated on an individual basis. Use the information below to estimate costs for various items that might be required under this specification. Check with a local supplier to obtain the latest information on products and costs. Prices should be increased for steep or rocky ground and decreased for very long fence runs.

### A. Fence:

1. Barbed wire
  - a. Three strand, metal T-posts \$2.15/lin. ft.
  - b. Four strand, metal T-posts \$2.25/lin. ft.
  - c. Three strand, wood posts \$2.50/lin. ft.
2. Brace panels (16'6" span) \$85.00 each
3. Woven wire
  - a. 39" hog and cattle wire, 1 strand barbed wire \$2.15/lin. ft.
  - b. 47" hog and cattle wire, 1 strand barbed wire \$2.25/lin. ft.
4. Woven wire brace panels (16'6" span) \$95.00 each
5. Chain link
  - a. 48" with top rail \$3.50/lin. ft.
  - b. 48" without top rail \$3.25/lin. ft.
6. Timber rail
  - a. 6" x 6" treated posts, 4 rails, 4' high \$5.50/lin. ft.
7. Remove old fence \$550-750/mile

### B. Gates: 1/

1. 16' wire gate with 2 brace panels \$425 each
2. 16' metal gate (used with cattleguard) \$550 each
3. 16' road closure gate \$1,000 each
4. 16' heavy duty pipe road closure gate \$1,500 each

1/ Includes furnish and install.

**C. Cattleguard: Steel decked with cleanouts:**

**WELDED STEEL DECK**

	Width	Length				
Load Rating		8' feet	10' feet	12' feet	14' feet	16 feet
H-15	7'5" 8'	\$1,057 1,093	\$1,280 1,327	\$1,460 1,507	\$1,795 1,857	SEE NOTE
H-20	7'5" 8'	1,095 1,162	1,355 1,435	1,562 1,655	1,856 1,994	
U-54	8'	1,276	1,620	1,831	2,143	
U-80	8'	1,355	1,711	1,923	2,328	

End Wings with posts (per set) \$176

*Note: For Welded steel decks longer than 14 feet, add the costs of smaller decks which sum to the length required.*

Treated timber base 2/ \$200 + \$46.00/ft. of deck

Hardware \$ 25 + 1.50/ft. of deck

Labor \$275 + 7.00/ft. of deck

Equipment \$200 + 8.00/ft. of deck

Total cost installed depends on the deck selected. Since the price of steel is fluctuating, it is a good practice to get a current price from a supplier. If cattleguards are to be constructed without cleanouts, reduce total costs by \$65.00.

2/ Increase base cost 65 percent when using a concrete base.

Suppliers: Powder River Co.  
388 E. 900 S.  
Provo, Utah 84601  
Ph: (801) 374-2983

**SECTION 609 - CURB OR CURB AND GUTTER**

Concrete curb (small quantity) - \$6.00 to \$7.00/lin. ft.

Concrete curb (large quantity) - \$5.00 to \$6.00/lin. ft.

Concrete curb and gutter (small quantity) - \$12.00 to \$15.00/lin. ft.

Concrete curb and gutter (large quantity) - \$7.00 to \$9.00/lin. ft.

Bituminous curb - \$2.50 to \$3.50/lin. ft.

Precast concrete curb - \$7.00 to \$10.00/lin. ft.



## SECTION 611 - DEVELOPMENT OF PITS AND QUARRIES

This specification can be used to compute costs for pit development and also costs for borrow material in conjunction with Section 203, 304, 311, and 619. If Pay Item 611 is not included in the contract development, costs should be included in the items requiring development of pits and quarries.

- A. **Clearing, Grubbing, and Slash Cleanup** - Compute acres involved in clearing the pit and estimate costs using the Time and Equipment Method; or allow unit prices that are similar to other timber sale clearing costs in that area.
- B. **Quarry Restoration and Cleanup** - Use Time and Equipment Method to compute costs. Costs will vary, depending on pit size and cleanup requirements.
- C. **Access Road** - Estimate using Time and Equipment Method or use unit prices for construction items, as covered in Section 203.

## SECTION 613 - REINFORCE EARTH WALLS

PANELS	SIZE	EQUIVALENT SQ. FT.
A & B	5' 7-1/2" X 4' 11-1/2" X 7-1/16"	24.2
C & D	5' 7-1/2" X 2' 4-3/4" X 7-1/16"	24.2
SP 1	5' 7-1/2" X 1' 9-1/2" X 7-1/16"	8.8
SP 2	5' 7-1/2" X 3' 1/4" X 7-1/16"	14.9
SP 3	5' 7-1/2" X 4' 3" X 7-1/16"	17.9
SP 4	5' 7-1/2" X 4' 3-1/2" X 7-1/16"	20.9
SP 5	5' 7-1/2" X 5' 3/4" X 7-1/16"	27.0
SP 6	5' 7-1/2" X 6' 1-1/8" X 7-1/16"	30.0

Average bid, in-place, \$25.00 - \$30.00 sq. ft.

Check with local supplier when making an estimate.

## SECTION 617- STRUCTURAL PLATE PIPE, PIPE ARCHES & ARCHES

- A. **Contact local suppliers for material and assembly costs for these items.** Use time and equipment calculations for excavation and backfill costs. Listed below are three suppliers who can help with design problems and provide cost information.

Contech Construction

Products Inc.

1935 N. 900 W.

SLC, UT

Phone: SLC: (801) 363-3873

Idaho Falls: (208) 522-1713

Boise: (208) 376-0662

Syro Construction

Centerville, UT

Ph. (801) 292-4461

Kaiser Aluminum

303 Wash. Mutual Blvd.

Spokane, WA 99201

Ph. (509) 624-4186

## SECTION 619 - RIPRAP

The cost of riprap includes furnishing, hauling, and placing of the riprap in its final position. Costs can vary considerably, depending on the amount, type of riprap, and how it is to be handled. Be sure to designate which type of riprap is desired when making an estimate.

### A. Typical Costs of Furnishing and Placing Riprap:

- |    |                       |                    |
|----|-----------------------|--------------------|
| 1. | Hand-placed Riprap    | \$20-\$40/cu. yd.  |
| 2. | Machine-placed Riprap |                    |
| a. | End Dumping           | \$10-\$20/cu. yd.  |
| b. | Derrick-placed        | \$20-\$40/cu. yd.  |
| 3. | Grouted Riprap        | \$50-\$60/cu. yd.  |
| 4. | Sacked Concrete       | \$65-\$75/cu. yd.  |
| 5. | Sacked Soil Cement    | \$50-\$60/cu. yd.  |
| 6. | Wire-enclosed Riprap  | \$80-\$100/cu. yd. |

B. **Haul Costs:** Calculate by using haul charts in Specifications 203.

### C. Additional Costs to be Considered If Appropriate:

1. Development and cleanup of pit or source - Use Time and Equipment Method.
2. Royalty charge in private pit - Obtain from owner.
3. Drilling and blasting of quarries - \$1.50 - \$2.00/cu. yd.
4. Access road development - Use Time and Equipment Method, or develop costs from Section 203.

## SECTION 621 - CORRUGATED METAL SPILLWAYS

Use time, material, and equipment.

A. **Pipe Cost Per Lineal Foot:** If round pipe is used, 70 percent of the unit price in SECTION 603 will apply.

B. **Elbow:** Include 2 Connecting Bands - See Section 603 for costs.

C. **Anchors:** Estimate by material and time.

D. **Berm Drain:** Unit cost consists of installation of prefabricated corrugated metal catch basin 12-inch diameter with slip joint and 20 feet of 8-inch corrugated metal downspout with downspout anchors.

- E. Flexible Downdrain:** Lowest price for larger quantity of 200 or more lineal feet.

Downpipe is measured by the quantity of lineal feet installed, including accessories, except inlets. Inlets are measured by the number installed and accepted. Costs include gaskets.

Anchors are not required for downpipes 20 feet or less in length. If the downpipe is over 20 feet, the first anchor will be placed at 20 feet and every 15 feet thereafter.

A culvert anchor installation may consist of stakes and bands or two metal fence posts and wire. The metal fence post-type culvert anchor may be used for downpipe up to 30 inches in diameter. Thirty-inch diameter pipe and larger will require anchors especially designed for them.

## **SECTION 623 - MONUMENTS & MARKERS**

- A. Culvert Markers** - Usually steel fence posts or U-channel posts.

1. Forest Service-furnished - allow \$15.18 per installation.
2. Allow \$23.00 per post for furnishing and installing.

- B. Delineator Posts** - usually flexible posts with reflective sheeting or button delineation.

Posts - \$10.53 each.

3" buttons - \$1.00 each.

Reflective Sheeting - 3" x 6" - cost per each

Engineer Grade - \$0.29

Hi-Intensity Grade - \$0.59

- C. Object Markers** - conforms to 3C-1, MUTCD.

With reflective sheeting:

Type 1 - \$22.50

Type 2 - 17.34

Type 2A - 11.90

Type 3 - 30.15

Installation Cost - use 100% of marker cost.

## **SECTION 624 - TOPSOILING**

Use Time and Equipment Methods to develop costs. The work involved includes furnishing, loading, hauling, and spreading the topsoil. If the soil comes from a central source, there could also be some pit development costs. If the soil is obtained by stripping and stockpiling from the road prism, then pit development costs are not applicable. Typical costs include:

- |   |                         |
|---|-------------------------|
| <b>A. Furnishing (Including Stockpiling)</b>  | \$1.35 - \$4.50/cu. yd. |
| <b>B. Loading</b>   | \$1.60 - \$2.20/cu. yd. |
| <b>C. Haul-Use Haul Charts</b>  |                         |
| <b>D. Spreading</b>   | \$1.10 - \$1.35 cu. yd. |
| <b>E. Source Development</b> - compute costs from applicable portions of SECTION 611. |                         |

## SECTION 625 - SEEDING & MULCHING

Use costs developed below to arrive at a base cost for turf establishment. Check with a local supplier for current costs of mulches not shown.

- A. **Seeding** (Including Application) @ 35#/acre \$100/acre
- B. **Fertilizing** (Including Application) @ 200#/acre \$200/acre
- C. **Water** - See Section 207
- D. **Dry Mulching** (Straw or Hay)  
See a 35# per acre  
Fertilizer at 200# per acre  
Straw or hay at 2 tons per acre  
Price for 20 acres or more \$400-\$500/acre
- E. **Hydro Seeding** (Wood Cellulose Fiber)  
Seed at 35# per acre  
Fertilizer at 200# per acre  
Wood cellulose fiber at 1 ton per acre  
Water as necessary  
Price for 20 acres or more \$600-\$700/acre
- F. **Mulching with Emulsified Asphalt** (Straw or Hay)  
Seed at 35# per acre  
Fertilizer at 200# per acre  
Straw or hay at 20 tons per acre  
Asphalt at 400 gallons per acre  
Price for 20 acres or more \$800-\$1,000/acre
- G. **Slope protection with Jute Mesh** 1.00/sq. yd.

## SECTION 626 - TREES, SHRUBS, VINES, AND GROUND COVER

Check with local suppliers for current prices. Cost shown below should be reduced if planting stock is furnished by the Forest Service. Some of the more desirable native species may not be available from commercial sources.

- A. **Trees** - Bare root stock \$10.00 to \$20.00 each, depending upon age of stock and species selected.  
Balled and burlapped stock \$30.00 to \$80.00 each, depending upon size and species selected.
- B. **Shrubs** - Bare root stock \$5.00 to \$10.00 each, depending upon availability of species selected.



## SECTION 630 - GABIONS

This item should be estimated on an individual project basis. There are a variety of sizes available and costs will vary with the size and number of units required. Check with the manufacturer to obtain the latest information. Equipment needed and the size of rock and haul of rock must be considered.

Letter Code of Size	Size					
	Length (Feet)	Width (Feet)	Depth (Feet)	No. of Diaphragms	Cu. Yd. Capacity	Price Each
A	6	3	3.00	1	2.00	\$36.00
B	9	3	3.00	2	3.00	51.50
C	12	3	3.00	3	4.00	64.80
D	6	3	1.50	1	1.00	25.00
E	9	3	1.50	2	1.50	35.25
F	12	3	1.50	3	2.00	44.00
G	6	3	1.00	1	0.67	22.00
H	9	3	1.00	2	1.00	31.00
I	12	3	1.00	3	1.33	37.00
Mattress	12	6	0.75		2.70	61.00

Unit prices F.O.B. plant, includes binding and connecting wire. Remember to add freight costs from F.O.B. point to the project.

### Call supplier for current costs:

Terra Aqua Conservation  
Division of Bekaert Wire Corp.  
PO Box 7546  
Reno, NV 89510  
Phone (702) 828-1930

Maccaferri Gabions West Coast Inc.  
3650 Seaport Blvd.  
West Sacramento, CA 95691  
Phone (916) 371-5892  
SLC (801) 596-2145

Hilfiker Retaining Walls  
PO Box 2012  
Eureka, CA 95502  
Phone (800) 762-8962  
(707) 443-5093

**Installation Costs** - Costs will vary depending on availability of rock, size, and number of units and equipment necessary to do the job.

Fill material may range from \$4.00 to \$8.00 per cubic yard plus structural excavation and labor to assemble and fill baskets. Average in-place installation costs, including fill material are \$50-70 per cubic yard. On major structures, the project may require excessive excavation and should be based on material, time and equipment basis.

## SECTION 631 - BIN WALLS

This item must be estimated on an individual basis. The variety of types and the site conditions can affect the unit costs. Contact the Regional Office Geotechnical group for assistance.

Costs are \$25.10/sq. ft. of facial area for up to 40 feet in height.

## SECTION 633 - SIGNS

This item should be estimated on an individual basis. Costs will vary depending on the type of sign and post required and the installation difficulty. For additional information contact Region 4 Sign Coordinator.

These average costs must be increased if sign posts are to be installed in rock fills or other situations requiring difficult excavation.

### A. Signs

For estimating purposes, use the following rates per square foot of sign face:

Warning & Regulatory Signs:

Engineer Grade Reflective Sheeting	\$8.77
Hi-intensity Grade Reflective Sheeting	\$9.65
Guide Signs:	
Engineer Grade Reflective Sheeting	10.44

### B. Posts

Tubular Steel - Break-away	\$2.30/lin. ft.
Wood (4" x 4")	\$1.08 lin. ft.

C. Hardware - Add \$3.47/bolt-fastener hardware (anti-theft bolt, nut, and washers)

D. Installation Costs - Use 100% of the sign, post, and hardware cost.

## SECTION 633A - SIGN REMOVAL

Costs for removal of signs could range in price from \$15 to \$50, depending on size, type, location, and disposal requirements. Estimate on an individual basis.

## SECTION 634 - PAINTED TRAFFIC MARKINGS

This item should be estimated on an individual project basis. Costs will vary according to the markings required. A truck can normally put down 400-500 gallons of paint per day of a 4-inch stripe. Use 16 gallons per mile for a 4-inch solid stripe and four gallons per mile for a 4-inch broken stripe for estimating purposes. Remember to compute the solid strip for any no-passing zones.

- |   |                          |
|---|--------------------------|
| A. Single 4-Inch Stripe (Broken)<br>(Includes the cost of glass beads)                                | \$0.03/lin. ft.          |
| B. Single 4-Inch Stripe (Solid)   | \$0.09/lin. ft.          |
| C. Parking Lots   | \$0.10 - \$0.15/lin. ft. |
| D. Add travel time and expenses of a truck and three people if striping is required in a remote area. |                          |

## SECTION 637 - EQUIPMENT RENTAL

The following schedule of Equipment Rental Rates include 5% profit and risk, fuel, oil, lubrication, repairs, maintenance, insurance, and incidental expenses. The rates are indicative of those charged for equipment of modern design in good working condition. Rates are obtained from the Rental Rate Blue Book for construction equipment, published by Dataquest Incorporated. The rates shown assume 168 work hours per month and are adjusted for the Intermountain area.

### EQUIPMENT RENTAL RATES

**AIR COMPRESSORS, PORTABLE, RECIPROCATING:** Includes hose and fittings, diesel powered.

Cubic Feet	Hourly Rate
100	\$ 5.21
175	7.71
425	18.93
600	25.02

**ASPHALT PAVER: (Blaw-Knox) - Diesel powered:**

Size	Hourly Rate
8-Foot (PF-22)	\$ 36.30
10-Foot (PF-120H) w/automatic screed control	80.44
12-Foot (PF-220) w/automatic screed control	117.60

**ASPHALT PRESSURE DISTRIBUTOR:** Includes diesel powered truck with full circulating spray bar, heater, insulation, power takeoff unit, and tachometer.

Truck	Capacity (Gals.)	Hourly Rate
4x2 - 175 HP	1,500	\$38.27
6x4 - 250 HP	3,000	48.31
6x4 - 275 HP	5,000	60.46

**BACKHOE: Two Wheel drive tractor, diesel powered, standard 24" bucket:**

Model	Digging Depth	Hourly Rate
Ford New Holland 340B	12' - 0"	\$16.51
Ford 555B	14' - 4"	20.33
Deere 410C	14' - 8"	23.16
Deere 510C	15' - 9"	26.88
Deere 710C	18' - 0"	37.23
Case 780C (30" bucket)	18' - 0"	36.78

**BROOMS AND SWEEPERS:**

<b>Pull type 7' Broom:</b>	<b>Hourly Rate</b>
----------------------------	--------------------

Type	
------	--

Traction driven	\$4.72
Engine driven (gasoline)	\$8.38

**Self propelled, gasoline powered:**

Model	
-------	--

Broce T-10 (7' broom)	\$13.51
Broce T-10 (8' broom)	\$12.68

**BRUSH CHIPPERS:****Trailer mounted, gasoline powered:**

Type	Max. Log Dia.	Hourly Rate
Chipmore TM-80-G1	8"	\$ 7.93
Chipmore TM-120-G3	12"	15.48
Chipmore TM-160-G3	16"	15.80

**CLAMSHELL: Crawler mounted, diesel powered:**

Model	HP	Without Bucket	Hourly Rate With H.D. Square Nose Bucket
Link Belt LS78C	100	\$56.85	\$61.69
Link Belt LS98C	120	67.03	72.49
Link Belt LS338	171	116.12	122.99

**CRANES: Hydraulic, self-propelled, diesel powered:**

Model	Capacity (Tons)	Maximum Reach (Feet)	Hourly Rate
Grove 1012	17.5(4x2)	30	\$41.40
Grove RT-58D	20(4x4)	60	45.61
Linkbelt HSP-8025	25(4x4)	80	59.58
Grove RT-740B	30(4x4)	110	79.60



**COMPACTORS:****Static, self-propelled, diesel powered, tandem:**

Model	Capacity (Tons)	Hourly Rate
Dresser S3-5B	3-5	\$ 9.92
Dresser S5-8A	5-8	16.27
Dresser S8-12A	8-12	18.04
Dresser S10-14A	10-14	18.68

**Vibratory, self propelled, diesel powered, tandem:**

Model	Drum Width	Hourly Rate
Raygo 2-36 Romper	36"	\$ 9.07
Dresser V0S2-66A	66"	36.71
Tampo RS 188A	84"	39.81

**Rubber-tired, pull type, static:**

Model	Number of Whells	Capacity (Tons)	Hourly Rate
Hercules			
PT-9	9	9.5	\$4.55
PT-11	11	13	5.19
PT-13	13	17	5.61

**Rubber-tired, self propelled, diesel powered, static:**

Model	Number of Wheels	Hourly Rate
Ferguson SP912	9	\$16.39
Ferguson SP1118	11	20.72
Cat PS-180	9	21.91
Ferguson SP1130	11	34.36
Sakai TS650C	7	42.81

**Sheepsfoot, pull type, vibratory:**

Model	Drum Width	Hourly Rate
Bomag BW6	67"	\$29.55
Southwest 566	72"	49.44
Southwest 756	78"	65.85

**Sheepsfoot, self propelled, tandem, vibratory:**

Model	Drum width	Hourly Rate
Rammax P-47	47.2"	\$10.91

**DRILLS: Mobile air track:**

Model	Maximum Hole Size	CFM Required	Hourly Rate
Sullivan VCR-350	3-1/2"	450	\$23.19
Ingersoll-Rand CM 351/VL 140	4"	750	38.58

**GRADERS, Motor: (Basic machine plus ROPS and rear scarifiers):**

Model	HP	Hourly Rate
Cat 120G	125	\$34.81
Cat 12G	135	41.20
Deere 770B	155	41.70
Cat 14G	200	69.40
Cat 16G	275	96.00

**HYDRAULIC EXCAVATORS: Crawler mounted tractor, diesel powered:**

Model	Capacity Cu. Yd.	HP	Hourly Rate
Deere 490D	1/2	75	\$29.88
Cat 211LC	0.68	94	35.79
Deere 790D	1	155	53.08
Cat 225D	1-1/4	165	63.07
Deere 990D-LC	2-3/8	265	92.50

**LOADERS:****Crawler type, diesel powered:**

Model	Bucket Size (Cu. Yd.)	Hourly Rate
Deere 350C	3/4	\$19.39
Cat931B	1	22.64
Cat 943	1-1/2	36.60
Case 1155D	1-3/4	37.99
Cat 953	2	46.69
Cat 963	2-1/2	59.21
Cat 973	3-3/4	86.86
Komatsu D155S-1	5-7/8	126.98

## LOADERS (CONT'D)

**Wheel type, diesel powered, articulated, 4-wd:**

Model	Bucket Size (Cu. Yd.)	Hourly Rate
TCM 810A	3/5	\$14.09
TCM 820	1	17.34
Deere 444D	1-1/2	21.31
Cat 926E	2	29.19
Cat 936E	2-1/2	35.83
Deere 644D	3	31.77
Cat 966C	4	51.51
Cat 988B	7	115.83

**PUMPING UNITS (Trash): Portable, tire mounted, self priming, air cooled, diesel:**

Pump Size	Hourly Rate
2"	\$1.78
3"	2.59
4"	3.77
6"	11.47

*Note: Unit includes 25' each of suction and discharge hose with couplings.*

**SAWS - Portable chain, sprocket nose bar:**

Size	Hourly Rate
18" Bar	\$1.65
24" Bar	2.92
30" Bar	2.92
36" Bar	3.07
43" Bar	3.13

**SCRAPERS: Single engine conventional, diesel powered (includes ROPS):**

Model	Capacity (Cu. Yd.)	Hourly Rate
Caterpillar 621E	14-20	\$100.87
Caterpillar 631E	21-31	160.34
Caterpillar 651E	32-44	203.86

**SKIDDERS, Cable:**

Model	HP	Hourly Rate
Franklin 105	77	\$29.55
Clark 664D	90	30.34
Deere 640D	120	41.66
CAT 518	130	43.15
Deere 740A	152	52.51

**SKIDDERS, Grapple:**

Model	Grapple Opening	HP	Hourly Rate
Timberjack 240A	72"	109	\$42.22
CAT 518	82"	130	51.65
Deere 648D	113"	120	45.90
Deere 740A	120"	158	62.72

**SPREADERS, AGGREGATE:**

	Hourly Rate
Self propelled, diesel powered, 14' spread	\$50.86
Tail gate, 8' with auger	3.80
Towed type, 7' with auger	2.54

**TRACTORS, CRAWLER: Power shift/torque converter:**

Model	HP	Hourly Rate	Hourly Rate w/Rippers
Komatsu D21-6	44	19.82	\$29.22
Case 450C	63	23.38	32.78
Deere 450G	70	24.00	33.40
Cat D4C	78	27.51	36.91
Cat D5H	120	43.16	57.12
Cat D6D	140	47.22	63.14
Fiat Allis FD20	227	81.25	103.92
Dresser TD25G	320	101.11	128.30
Cat D8L	335	108.23	135.42
Cat D9N	370	112.69	146.46
Cat D10N	520	150.46	185.76
Cat D11	770	241.81	287.47

**TRUCKS:****Rear dump, highway type, diesel powered:**

Axle Configuration	Capacity (Cu. Yd.)	Hourly Rate
4x2	5-6	\$13.07
6x4/6x2	8-10	28.18
6x4/6x2	10-12	26.22
6x4/6x2	12-18	32.98



**TRUCKS: (CONT'D)****Rear dump, off highway, diesel powered:**

Model	Capacity (Cu. Yd.)	Hourly Rate
Euclid VME R25	15 - 19	\$54.96
Cat 769C	23 - 30	80.54

**Pickups, flatbed, or stake body:**

Axle Configuration	Hourly Rate
4x2 4000 GVW	\$ 8.37
4x2 9000 GVW	10.66
4x2 15,000 GVW, Diesel	11.81
4x2 24,000 GVW, Diesel	12.40
6x4 41,000 GVW, Diesel	15.13

**Water tankers, highway:**

Capacity in Gallons	Hourly Rate
1,500 (gasoline, 4x2)	\$18.21
2,000 (gasoline, 4x2)	18.45
2,500 (diesel, 4x2)	17.57
3,000 (diesel, 4x2)	25.41
4,000 (diesel, 6x4)	28.47
5,000 (diesel, 6x4)	31.81

**Water tankers, off highway, diesel:**

Capacity in Gallons	Hourly Rate
5,000	\$ 42.54
6,000	76.74
8,000	111.28

**Truck tractor w/lowboy trailer (tandem axle):**

Truck Type	Lowboy Capacity (tons)	Hourly Rate
6x4	35	\$34.17
6x4	50	55.84

**WELDERS: Portable (diesel):**

AMPS	AC Hourly Rate	DC Hourly Rate
200	\$4.15	\$ 5.87
350	10.48	8.91
400	11.03	9.10



## **SECTION 700 - MATERIALS DETAILS**





## NON-WOVEN FABRIC

Trade Name	Product	Manufacturer	Weight oz/sy	Thickness mills	Sieve C.O.E. CW02215	ASTM D-4491 cm/sec	ASTM D-751 psi	ASTM D-3786 psi	ASTM D-751 lb.	ASTM D-3787 lb.	ASTM D-4632 lb.	Fill lb.	ASTM D-4632 %	Warp %	Fill %	ASTM D-4355 %	Roll Width ft.	Roll Len. ft.	Roll lbs.	Cost \$/sy
POLYFELT	500	ELJEN	4.5	60	40-80	.40	185			60			50			85	15.0	360	180	0.75
PROPEX	4545	AMOCO	4.0	80	70	.20	215			65	90		50			70	15.0	420	210	0.52
SUPAC	4NP	PHILLIPS	4.0	40	60-100	.20		240	70					80			15.0	300	145	0.43
TREVIRA	1112	HOESCHST	3.4	60	70		155	175	50		80	90		80	85		15.0	400	118	0.42
TREVIRA	1114	HOESCHST	4.1	65	70-100			180	200	60		100	110	75	85		15.0	400	142	0.48
POLYFELT	600	ELJEN	6.0	80	60-100	.40		255		75			50			85	15.0	360	235	1.00
PROPEX	455	AMOCO	6.0	90	70	.20	300			90	120		50			70	15.0	300	200	0.66
SUPAC	5NP	PHILLIPS	5.0	50	80-120	.20		300	90					75			15.0	300	175	0.57
TREVIRA	1120	HOESCHST	6.0	95	51-100		285	315	90		155	175		80	85		15.0	300	156	0.71
POLYFELT	700	ELJEN	8.3	105	80-120	.40		345		100			50			85	15.0	360	320	1.26
PROPEX	4553	AMOCO	8.0	100	70	.25	300			130	165		50			70	15.0	240	215	0.95
SUPAC	8NP	PHILLIPS	8.0	80	80-100	.30		410	130					85		70	15.0	150	145	0.81
TREVIRA	1125	HOECHST	7.4	110	70-100		350	380	110		205	230		75	85		15.0	300	193	0.86
POLYFELT	750	ELJEN	10.3	120	100-140	.40		425		115			50			90	14.0	300	310	1.53
SUPAC	10NP	PHILLIPS	10.0	100	80-100	.30		470	160			340		85		70	15.0	150	175	1.08
TREVIRA	1135	HOECHST	10.5	150	70-100		485	525	155		300			80	90		15.0	300	273	1.24
POLYFELT	800	ELJEN	12.0	130	100-140	.40		450		130			55			90	13.0	300	335	1.86
PROPEX	4557	AMOCO	12.0	150	70	.15	750			200	250		50			70	15.0	15	220	1.34
SUPAC	12NP	PHILLIPS	12.0	120	100-120	.30		565	190					90		70	15.0	150	205	1.21
TREVIRA	1145	HOECHST	13.5	175	100-140		575	625	180		350	400		90	95		15.0	300	352	1.60
POLYFELT	1000	ELJEN	16.2	160	140	.35		490		170	350		80			90	10.0	300	345	2.88
PROPEX	4561	AMOCO	16.0	200	70	.20	750			250	300		50			70	15.0	120	220	1.75
SUPAC	14NP	PHILLIPS	14.0	140	100-140	.30		660	225					90		70	15.0	99	165	1.50
TREVIRA	1155	HOECHST	16.2	210	120-170		750	825	240		500	560		90	95		15.0	300	422	1.92

Note: Unit prices are subject to quantity discounts. Check with distributor.

# WOVEN FABRIC

Trade Name	Product	Manufacturer	Weight oz/sy	Thickness mils	Sieve C.O.E. CW02215	ASTM D-4491 cm/sec	ASTM D-751 psi	ASTM D-3786 psi	ASTM D-751 lb.	ASTM D-3787 lb.	ASTM D-4632 lb.	Fill lb.	ASTM D-4632 %	Warp %	Fill %	ASTM D-4355 %	Roll Width ft.	Roll Len. ft.	Roll lbs.	Cost \$/sy
CONTECH	150	CONTECH	3.3	15	20-40		275		40			120					15.0	300	69	0.44
CONTECH PROPEX SUPAC	200 2002 4WS/UV	CONTECH AMOCO PHILLIPS	5.0 4.0 4.0	18 23 20	40-70 30-70 40		465 400		120 80	90	200	260	15				15.0 12.5 12.5 15.0 17.5	300 504 300	130 220 123 147 172	0.50 0.51 0.46
SUPAC	5WS/UV	PHILLIPS	4.5	20	40	.010		460	90					22		90	12.5 15.0 17.5	300	136 163 190	0.52
CONTECH PROPEX SUPAC	300 2006 6WS/UV	CONTECH AMOCO PHILLIPS	6.0 6.0 6.0	25 30 25	40-70 30-70 45	.015	600 600	650	130 115	120	275	130	15	22			12.5 14.5 12.5 17.5	360 310 300	188 220 175 245	0.67 0.69 0.67
CONTECH PROPEX CONTECH	70/06 1199 100/08	CONTECH AMOCO CONTECH	6.6 6.5 6.9	19 19 19	70-100 70-100 80-100	.040 .010	520 510 540		150 160	140	290	285 320	32	28 28	28 28	90	18.0 6.0 5.0	300 450 300	83 140 72	1.17 1.07 1.31
CONTECH	400	CONTECH	5.9	29	30-40	.120	440		150			260					13.0	300	160	0.94
CONTECH	500	CONTECH	8.7	26	30-40	.120	790		200			420					12.0	300	218	1.25
CONTECH	600	CONTECH	14.4	65	30-70	.050	1440		250			580					15.0	300	450	2.36
CONTECH	1250	CONTECH	22.7	100	30	.040	1200		225			280					16.7	300	790	2.89
CONTECH	1250X	CONTECH	28.5	100	30	.040	1300		250			650					16.7	300	992	3.45

Note: Unit prices are subject to quantity discounts. Check with distributor.

# SURFACE DRAINS

Trade Name	Product	Manufacturer	Weight oz/sy	Thickness mils	Sieve C.O.E. CW-02215	ASTM D-4491 cm/sec	ASTM D-751 psi	ASTM D-3786 psi	ASTM D-751 lb.	ASTM D-3787 lb.	ASTM D-4632 lb.	Fill lb.	ASTM D-4632 %	Warp %	Fill %	ASTM D-4355 %	Roll Width ft.	Roll Len. ft.	Roll lbs.	Cost \$/sy
ELJEN	DRAIN	ELJEN	4.0	57	70-100	60	170			55	55			145		115		85		SEE BELOW

CORE	PIPE SACK	HEIGHT	LENGTH	COST/SF
SINGLE	NO	4'-24"	10'	0.23
DOUBLE	NO	4'-24"	10'	0.70
SINGLE	YES	4'-24"	10'	0.30
DOUBLE	YES	4'-24"	10'	0.74
SINGLE SHEET				
SINGLE	N/A	1.5'-20'	5'-20'	2.31

Note: Unit prices are subject to quantity discounts. Check with distributor.

MANUFACTURER	TRADE NAME	REGIONAL/LOCAL DISTRIBUTOR
1. Amoco Fabrics Company 900 Circle 75 Parkway Suite 3000 Atlanta, GA 30339 (404) 984-4444	Propex	Nilex Corporation 2191 S. 3rd. W. Salt Lake City, UT 84117 (801) 261-8885
2. Eljen Corporation 15 Westwood Road Stoors, CT 06268 (203) 429-9486	Eljen Drain Polyfelt	Rich Minter Master Distributing Denver, CO (303) 595-8722
3. Hoechst Fibers Industries Spunbound Business Group P.O. Box 5887 Spartanburg, SC 29304 (800) 845-7597	Trevira	Contech Construction Products 1935 N. 900 W. P.O. Box 553 N. Salt Lake City, UT No. SLC: (801)363-3873 Idaho Falls: (208)522-1713 Boise: (208)376-0662
4. Phillips Fibers Corporation Western Zone 1900 Point West Way Sacramento, CA 95815 (916) 924-3151	Supac	Intermountain Piping Systems 1055 W. 650 N. Centerville, UT 84014 (801) 298-9696



## APPENDIX



## IMPLEMENTATION OF NFMA 14I

### A. Relationship between Davis-Bacon wage rates and the purchaser's applicable wage rates for equivalent construction skills.

The relationship between wage rates was examined in the Intermountain Region. Labor classification from Davis-Bacon wage rates were compared with wage rates from purchaser's operations. This study resulted in the following percentages that shall be used in reducing Davis-Bacon labor costs to obtain purchaser labor costs in the following areas:

Wyoming	No Reduction*
Idaho	45 Percent
Utah	63 Percent
Toiyabe NF	Not Determined

The Toiyabe National Forest contains several wage rate areas which vary greatly by each county and state. The Toiyabe Forest will develop their own wage rate relationships using available purchaser and Davis-Bacon wage rate data and information received from border Forests in Region 5. These results will be coordinated with the Director of Engineering prior to development a timber sale road cost estimate.

\*Wyoming should reduce Public Works Unit Costs as compared to Regional Public Works Costs due to the low Davis-Bacon rates in effect. Comparison between Wyoming Davis-Bacon rates and average rates in Utah and Idaho indicate Wyoming rates are approximately 40 percent lower.

### B. Percentage of total construction costs involving labor.

Development of the percentage of total construction cost involving labor requires a separate analysis of each work item. The recommended approach is to develop a cost estimate based on a separate analysis of labor, equipment, and materials for each work item. When using the cost by labor, equipment, and materials method, reduce the Davis-Bacon labor cost by state's reduction factor to arrive at the purchaser labor cost. Use the percentage of labor and the state's reduction factor for work items where labor is not calculated separately. Whether using this approach or data contained in cost guides, the percentage of labor derived should reflect the differences in degree of difficulty, job conditions, and other judgmental factors which must be weighed for each project.

We have developed the following labor percentage range guidelines for your use. These are guidelines only and their use is optional. The cost estimating process shall document the actual percent of labor selected for each work item and the reasons for selection:

Work Item	Percent Labor	Low Percent Factors	High Percent Factors
171-Construction Staking (Reduce only if common for purchaser to perform with own forces.)	80-90	Light brushing, low precision, gentle terrain	Heavy brushing, high precision, difficult terrain

201-Clearing and Grubbing	51-62	Small timber, light ground cover, gentle terrain, good soils, scattering, accessible to equipment.	Large timber heavy ground area, difficult terrain, poor soils and rock pile and burn, inaccessible to equipment.
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203-Excavation and Embankment	25-45*	Gentle terrain, good soils, wide tolerances, no blasting.	Difficult terrain poor soils and rock, close tolerance, heavy blasting.
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\*This item may be broken down as follows:

- 24% - Movement Dirt
- 30% - Compaction
- 25% - Slope, Rounding, and Benching
- 45% - Scarification
- 86% - Drill and Blast
- 90% - Traffic Control
- 23% - Station-Yard Overhaul
- 37% - Cubic Yard-Mile Overhaul

206A-Excavation for Culverts & Minor Structures	60-70	Gentle terrain, good soils, easy equipment access, no dewatering.	Difficult terrain, poor soils and rock, equipment access difficult, dewatering required.
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304-Aggregate Base		Requires analysis of equipment, labor, and materials. Do not reduce for crushing labor if purchaser is not normally equipped to perform.	
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306-Reconditioning Existing Roadbed	35
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400-Bituminous Pavement 500-Bridge Construction		No reduction if purchaser is not equipped to perform. Requires analysis of equipment, labor, and materials.	
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<b>601-Mobilization</b>	40	Short travel distance with few pieces of equipment to dismantle and reassemble.	Long travel distance, many pieces of equipment to move, dismantling and assembly of equipment, semi-permanent structures, platforms, etc., to erect for project support.
<b>603-Metal Pipe &amp; Corrugated Polyethylene Pipe (Installation only)</b>	55-65	Gentle terrain, easily available bedding and backfill material.	Steep pipe grade, poor gradation for bedding and backfill material.
<b>605-Underdrains</b>	90-(Installation Only) 10-Backfill 10-Filter Cloth 25-Special Granular Backfill		
<b>607-Fences, Gates and Cattleguards</b>	10-15 (Does not include hand-made gates)		
<b>619-Riprap</b>	45 - Hand-Placed 20 - Machine-Placed 60 - Sacked 75 - Wire-Enclosed		
<b>621-Corrugated Metal Spillways (Installation Only)</b>	80		
<b>625-Seeding and Mulching</b>	35-50	Hydromulch, flat slopes, large project.	Hand-placed mulch steep slopes, small project.
<b>630-Gabions</b>	28		

An example of cost estimating calculations follow:

1. Estimated Cost - Excavation = \$1.75/cy
2. Percent Labor = 30 Percent
3. Labor Cost = 30 Percent x \$1.75 = 0.53
4. Idaho Wage Rate Reduction = 45 Percent x \$0.53 = \$0.24
5. Purchaser Credit Cost - Excavation = \$1.75 - 0.24 = \$1.51/cy

The amount of labor involved in work items not shown above must be determined by analysis of labor, materials, and equipment for the item.

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